U51
no.2
University Library

THE PLANT DISEASE BULLETIN

Issued By

The Plant Disease Survey

SUPPLEMENT 2

Summary of Plant Diseases in the United States in 1918 -- Diseases of Field and Vegetable Crops.

May 30, 1919

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

SB
599
U51
no.2

SUMMARY OF PLANT DISEASES IN THE UNITED STATES IN 1918

II. DISEASES OF FIELD AND VEGETABLE CROPS

Prepared by

R. J. Haskell and G. H. Martin, Jr.

CONTENTS

Diseases of Potato 42
Diseases of Tomato 60
Diseases of Bean..... 70
Diseases of Onion..... 77

DISEASES OF POTATO

Late blight caused by Phytophthora infestans (Mont.) DeBary.

Late blight occurred to some extent both on the southern early crop in the spring, and on the northern, late crop in the summer and fall.

It was reported first from Florida where it developed quickly during the last two weeks of April and early May. Special search for it between the dates of March 13 and April 9 failed to reveal its presence but the continued rains that delayed harvest in latter April and early May afforded favorable conditions for developing Phytophthora on the foliage. During harvest the tubers became heavily infected by contact with the diseased tops, and the moist condition in the sacks and barrels after harvest afforded a very favorable opportunity for the development of rot. The result of this late epidemic was that many shipments of Florida potatoes were found to be very badly rotted when arriving at destination. Market inspection records at many of the larger northern markets showed high percentages of late blight rot coming chiefly from Florida but also from Alabama, Georgia and the Carolinas. Some cars showed as high as 30% rot from Phytophthora. The diagnosis of late blight rot in the field and in shipments of potatoes from the South was somewhat complicated this season by the large amount of slimy soft rot that occurred following injury from excessive soil moisture previous to and during digging. (See slimy soft rot, page 59.)

The reduction in yield to Florida growers from late blight is estimated by H. E. Stevens at about 5% but on account of the great development of the disease on potatoes in shipment the total loss of Florida potatoes will greatly exceed, and will probably at least double, the above estimate.

An unusual circumstance is the report of the appearance of late blight for the first time in Louisiana (May) and Arkansas (May 20). In the latter state it became general, on the tops to such an extent that the crop was reduced about 40-50% (Elliott Pl. Dis. Bul. 2:130, 1918). There was only very little tuber rot however, probably on account of the hot, dry weather of June that followed the killing of the tops in May. The weather of this latter month was unusually favorable for the blighting of the foliage in Arkansas.

In the northern potato belt late blight occurred in three distinct regions; (1) the northeastern area, which includes New England, New York, Pennsylvania, New Jersey, Maryland, Virginia and West Virginia; (2) the Iowa, Minnesota,

Wisconsin area, which involves portions of those three states; and (3) the northwestern area, which includes Oregon and Washington.

In the northeastern area the disease was first noticed in the various states about the middle of July although in New Jersey and Pennsylvania it was noted the latter part of June. At Presque Isle, Maine, it was first observed on plants from infested tubers in an experimental plot as early as July 5, but the first field report from Maine was not until July 17.

In all of these states the disease appeared very threatening in July as an abundance of the fungus developed on the diseased tops in many places. The dry, hot weather commencing in early August, however, checked the development and spread of the fungus and the comparatively dry fall that followed prevented the disease from assuming epidemic proportions.

In general the disease can be said to have been of only slight importance in West Virginia, New Jersey, Pennsylvania, New York, Connecticut and Massachusetts. It was of slightly more consequence in Vermont and New Hampshire and was most severe in Maine. In the latter state many vines were killed and the fungus was present in abundance in practically all fields. Heavy rains previous to digging would have resulted in great losses from blight rot but fortunately the fall was dry up to the time the tops of late varieties were killed by frost (Sept. 10) and the progress of the disease was arrested.

In Michigan, Minnesota and Wisconsin a thorough survey for late blight was maintained during the season. In each of these states there was located a Survey field man who made the search for late blight a major project. The findings in their states and also in Iowa, where a special survey was made during the latter part of the summer, are therefore probably fairly representative of the actual conditions.

In 1917 no blight was found in this north central area except in one county in the northern part of Iowa. None was found in Wisconsin although a special search was made for it. Since home grown seed is mostly used in Wisconsin it was thought that the sources of infection for this year's crop would be few. This proved to be the case as the disease was found in 1918 in rather small amounts and in only two widely separated localities in the northwest and north central part of the state.

The chief region of infestation in the north central area involved northern Iowa and southern Minnesota. Here the disease became evident about the second week in August but the indications were that it had made its initial appearance in July. The weather of August was not especially favorable for blight so that a large proportion of the fields escaped much loss. A considerable amount of rot developed later on, however, so that the total loss, in some places at least, was large. At a number of points in Mitchell County, the principal potato county in the Iowa blight zone, every field had from 10 to 20% rotted tubers.

The occurrence of late blight in this north central area is correlated very closely with the precipitation records for the month of July.

In the northwestern area the disease was reported from Bellingham, Washington, (May 3) and points along the coast in Oregon. It is usually of annual occurrence in this region.

Taking everything into consideration the season of 1917 was not what would be called a bad blight year. In the North, the stage was set for a severe epidemic but it failed to develop. In the South, very unusual weather conditions favored the disease so that it was unusually severe on the tubers in Florida and appeared for the first time in Louisiana and Arkansas, causing damage to the tops.

The question as to whether or not it is profitable to spray potatoes with Bordeaux in various parts of the country is an important one and has long been a matter

of uncertainty. In the summer of 1918 the committee on potato spraying, organized by the War Emergency Board of American Plant Pathologists, attempted to get from pathologists in all states a statement of opinion on this subject. Replies were received from about twenty-four states. The detailed results of this work are not yet available but the general conclusions have been kindly supplies by G. R. Bisby, chairman of the potato spraying project committee, and are as follows:

"The results obtained in 1918, supplementing previous data, show that spraying with Bordeaux pays in New York and the northern New England states, though its value is more doubtful in Connecticut, Rhode Island, and New Jersey, especially with early potatoes such as Irish cobblers. In Pennsylvania strikingly favorable results were secured, and Bordeaux is valuable in parts of Virginia. In Wisconsin and Minnesota spraying is said to pay especially in regions of more intensive potato culture, and on certain types of soil. In the central states of Indiana, Kansas, and South Dakota, results are uncertain. In Washington spraying appears unnecessary in the Yakima Valley, for example, where the potato crop is little troubled with diseases, though it is probably advisable in the Puget Sound Region."

Early blight caused by Macrosporium solani E. & M.

Early blight occurred generally throughout the country and was reported from all states with the exception of a few of those in the Great Plains and Rocky Mountain area. It has never been reported to the Survey from Montana, Arizona or Nevada but it probably occurs there.

In general it was not especially destructive and probably did less damage to the potato crop as a whole than usual. In some places, however, especially in parts of New Jersey, Pennsylvania, West Virginia, Georgia and Florida, where heavy losses are often experienced, it was serious and reduced the crop very considerably. Epidemics of early blight frequently occur in the north central states but during 1918 no especially heavy losses were reported.

The weather conditions that favor this disease do not seem to be well understood although a number of collaborators state that high temperatures and abundant moisture are favorable.

Observations made and reported by collaborators and others in 1918 seem to bear out the theory that nearly mature plants, or plants that have become weakened or brought to early maturity through drought, excessive heat, or some other factor, are more susceptible to blight than healthy, vigorously growing plants. Thus in New Jersey the disease is said to have become severe, following a very severe outbreak of tip-burn which was brought on by unfavorable climatic conditions. In Florida the disease was found to be much more severe in the southern part of the state during the latter part of March and early April, than in the northern portion where the severe temperature was lower and the plants younger. The following extract is from the report of A. G. Newhall, Minnesota. "Sept. 2. Early blight is gaining a foothold in about two-thirds of the fields, running up to 90 and 100% in a very few fields of Triumphs and Cobblers. It is not nearly so general on late potatoes and is noticeably lacking in fields of both late and earlies which were planted very late. It seems to be much worse on light, sandy, dry or "quick" soils. I have records on some 64 fields in Pine, Carlton and Kanabec counties seen in the last four days."

Dates of earliest recorded appearance of early blight in 1918.

April	Louisiana	July 1	Connecticut
April 4	Mississippi	July 2	New Hampshire
April 10	Georgia	July 10	Minnesota
April 15	Tennessee	July 15	Massachusetts
May	Oklahoma	July 18	Pennsylvania
May 20	Missouri	July (last)	Wisconsin
June (last wk.)	Kentucky	August 30	Vermont
June 27	New York		

Early varieties are mentioned as most affected in Wisconsin, Minnesota, and Illinois. In Pennsylvania the Carman was reported as very susceptible in Clarion County while in Connecticut Green Mountain was thought to be chiefly affected.

Spraying for early blight is not commonly practiced. Tennessee, Wisconsin, and New York report that it is successful where practiced.

Tip burn (non-parasitic).

Tip burn was reported in 1911 from a majority of the states in the eastern half of the United States. Although it was common in the south it did not materially reduce the crop. In the belt of states from Massachusetts westward to the Dakotas, however, the condition was of unusual severity and caused a great reduction in yield in many places. It was reported as very severe in parts of Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa and North Dakota. In Pennsylvania the affection was so heavy that it is estimated that the early crop was reduced by 40% and the late crop by 15%. In West Virginia it was said to be extremely severe and in Michigan, Wisconsin, and Minnesota it was reported as the most conspicuous and destructive trouble. Collaborators in the states of Wisconsin, West Virginia, and Connecticut mention the presence of insects in connection with the trouble. In many cases early blight was associated with tip burn to such an extent that it was difficult to distinguish between the effects of the two diseases. It will be noted that the two troubles were severe in the New Jersey, Pennsylvania, and West Virginia area.

The following dates indicate the approximate time when the disease first began to be general in various states for which data is available.

1918

May 25	Mississippi	July 9	Michigan
June 6	Pennsylvania	August 1	Wisconsin
June (last part)	Kentucky	August 8	Connecticut
July 6	Minnesota		

Collaborators are unanimous in expressing the opinion that the early crop suffered most. The varieties Triumph in Wisconsin and Minnesota, Early Ohio and Early Rose in Wisconsin, are said to have been most affected while Rural New Yorker in Wisconsin and Dibbles Russett in New York are mentioned as resistant.

Sprayed plants in Wisconsin showed less of the trouble although they were by no means free from it.

Fusarium wilt caused by Fusarium oxysporum Schlecht.

Fusarium wilt was reported from the following states. Massachusetts, New York, Pennsylvania, West Virginia, Kentucky, Tennessee, South Carolina, Texas, Oklahoma, Ohio, Michigan, Wisconsin, Minnesota, North Dakota, Kansas, Montana, Wyoming, Colorado, Utah, Nevada, Washington and Oregon. Undoubtedly the disease occurred, to some extent at least, in practically all states where potatoes are grown. No reports are available in the past records of the Plant Disease Survey, however, to show that the disease has been collected in New Hampshire, Georgia, Mississippi, Illinois, or Arizona although there is little doubt that it occurs in these states.

Within the various states the disease is frequently reported from the valleys and lake regions. Thus in New York it is most serious in the Hudson River Valley, in West Virginia and Ohio in the Ohio Valley, in Minnesota and North Dakota in the Red River Valley, and in California it is said to be prevalent in the San Fernando Valley. In Utah and Nevada it is reported from the lake regions.

This is probably the most destructive potato disease in certain parts of the central and western states and ranks among the first in importance of the potato diseases of the country. It was reported as being rather worse than usual in New York, Minnesota, Utah, and Nevada, and less than normal in Wisconsin and North Dakota. The heaviest losses were incurred as usual in the group of states comprised of the Dakotas, Colorado, Utah, Nevada, Idaho, and California, and in the area covered by Pennsylvania, West Virginia, Ohio, Indiana, and Michigan. It apparently does not cause much damage in the South where early potatoes are grown early in the season or where "second croppers" are produced late in the fall, and it is either absent or of no consequence in the northernmost parts of the country where the growing season is cool. It will be noticed that the states most affected are for the most part along the southern border of the late potato belt where comparatively high summer temperatures prevail at a time when the potato plant is forming tubers.

It is probable that during last season, and in former years, Fusarium wilt has been confused more or less with other diseases, particularly Verticillium wilt, black leg, Rhizoctonia and various malnutrition disturbances.

The following dates show the time of year when Fusarium wilt was first reported in various states during 1917 and 1918.

1917

June 6	Virginia	July 14	Utah
June 12	North Carolina	July 15	Colorado
June 13	Tennessee	July (late)	Idaho
June 25	North Dakota	August 3	New York
July 3	Pennsylvania	August 3	Minnesota
July 7	Arkansas	August	Montana
July 10	Ohio	August (late)	Alabama

1918

July 1	Tennessee	July 18	Pennsylvania
July 1	Kentucky	July	Wisconsin
July 8	Colorado	July 24	New York
July 9	Michigan		

Frandson in Nevada mentions Burbank as more susceptible than other varieties.

Verticillium wilt caused by Verticillium albo-atrum Reinke & Berth.

The first survey report of the occurrence of the potato disease caused by Verticillium was from the state of Washington in 1911. Since that time it has been reported from Maine (1913, 1915, 1917, and 1918), New York (1914, 1915), Ohio (1917, 1918), Wisconsin (1918), Utah (1915, 1917), Idaho (1913, 1917), and Oregon (1915-1918). As will be seen from the above, the 1918 reports are from Maine, Ohio, Wisconsin, and Oregon. The earlier reports from Maine showed the disease in the southern and eastern portions of the state but within recent years it is becoming more frequently reported from the Aroostook County section. In New York the fungus has been isolated from vines grown in the western and eastern portions of the state and on Long Island. In Oregon the disease seems to be confined to the western half of the state. The known range in 1918 is shown on the accompanying map. It will be noticed that in general this range of the disease is along the northern portion of the country.

According to present information Verticillium wilt does not seem to be of great economic importance except in western Oregon. Regarding its seriousness in that state in 1918 the following is quoted from a statement of C. E. Owens: "This is one of the most serious diseases of potatoes in Oregon. It is present in nearly all fields, probably averaging 3 to 5% and running as high as 20% in a few cases". H. P. Barss says further: "In the potato seed certification work this year this was encountered more frequently than any other one disease". Although in other sections of the country the disease is not considered as an important one, there are individual farms, particularly in Maine and New York, where it is the cause of serious difficulty. It is probable that this disease is causing more damage than is generally realized but because of its confusion with other troubles, such as Fusarium wilts and blights, tip burn, drought, and malnutrition injury, etc., it has been generally overlooked. It seems also that it is increasing in amount from year to year and so becoming a problem to be reckoned with in the future.

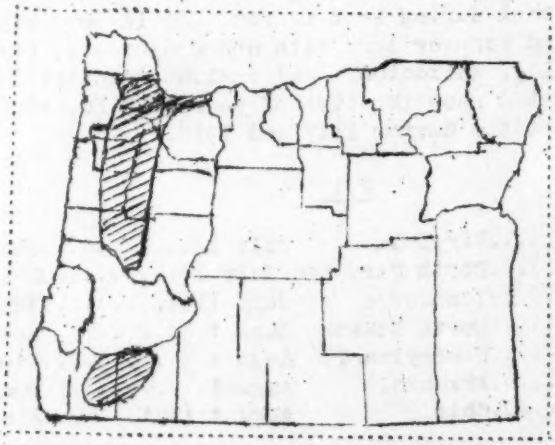

Fig. 4. Regions in Oregon where injury from Verticillium wilt was recorded in 1918. (After map prepared by H. P. Barss and C. E. Owens.)

Bacterial wilt caused by Bacillus solanacearum E.F.S.

This disease occurred in various parts of the south and was reported from South Carolina, Florida, Louisiana, Texas, and Arkansas. Single collections of

specimens were made by collaborators in the states of New Jersey, New York, and Pennsylvania and questionable reports of occurrence came from Ohio and Nevada.

Florida seems to be the only state where the disease was of much importance. In that state it was one of the most destructive potato diseases. In a number of the most important potato counties it was present in almost every field affecting as high as 70% of the plants in some instances. It is estimated that .5-10% in St. Lucie County were affected with a probable reduction in yield of at least 5000 barrels of potatoes. In Flagler County where inspections were made on 700 acres, it is estimated that a 10% loss was sustained, and in Clay County a similar loss is thought to have occurred. Crop rotation in Florida is reported as giving fair results in reducing the disease but many growers object to being obliged to resort to rotation as a control measure. There seems to be a demand for resistant varieties.

Black leg caused by Bacillus atrosepticus Van Hall. or B. phytophthorus Appel. or B. solanisaprus Harrison

Black leg was reported in 1918 from the New England States, New York, New Jersey, Pennsylvania, West Virginia, Ohio, Michigan, Wisconsin, Minnesota, Iowa North Dakota, Montana, Utah, Washington, Oregon, Tennessee, Georgia, Louisiana, Missouri, New Mexico and Texas. This is the first year that reports of occurrence have come from the last six mentioned states, all of which are in the South.

Black leg is a disease of the northern part of the country. Past records, and also those of the present year, show that it is reported most frequently from, and causes the most damage in, the extreme northern tier of the states. In 1918 the heaviest losses occurred in northern Michigan and Wisconsin, Minnesota, North Dakota, Montana, and Utah. In these states, with the exception of Wisconsin and Montana, the disease is said to have been present in more than the average amounts. In the North Atlantic States, particularly in Maine and New Jersey where the disease has been important in the past, it was less prevalent than usual. According to W. J. Morse, black leg has been becoming gradually less during the past decade in Maine. This is attributed to the more general knowledge of the nature of the disease and the methods of control. In New Jersey M. T. Cook finds that the disease has been on the decrease during the past seven years until this last year only a small amount was evident.

In Michigan E. A. Woodcock visited 328 potato fields in 20 different counties in all parts of the state. The disease was found to be present in 27% of these fields in amounts ranging from a trace to as high as 18% with an average of 1.8%. An average estimate for the total loss in the state is about ½%.

In Wisconsin W. H. Wright found black leg present in 28 of the many potato fields he visited during the year in amounts ranging from 1% to 25% (average 4⅓% in affected fields).

From Minnesota A. G. Newhall reported as follows concerning the situation in the Red River Valley: "I would say that black leg is getting to be the limiting factor in the production of a good crop in this region. It is apparently worse this year than ever before. Several large acreages were seen with between 20 and 30% and one field was reported with 60% affected plants. Probably Clay County has been hit the hardest which accounts for sixty farmers wanting to get seed plots started."

In North Dakota H. L. Bolley reported the disease as unusually destructive in the Red River Valley, due to the gradual increase of infected seed. Possible overwintering of the causal organism in the soil was mentioned. According to G. R. Hill, black leg was particularly bad on early potatoes in 1918 in Utah. In Davis County 5 to 20% of the early potato vines were killed because of the disease.

The following dates show roughly the time of the year when black leg was first noticed by collaborators in 1917 and 1918.

1917

May 18.....	North Carolina	July 6.....	Minnesota
May 28.....	Virginia	July 6.....	Ohio
June.....	Iowa	July 9.....	Maine
June.....	Wisconsin	July 12.....	Massachusetts
June 10.....	Pennsylvania	July 21.....	New Hampshire
July 3.....	New York		

1918

April.....	Louisiana	July 3.....	Minnesota
May 3.....	Georgia	July 9.....	Michigan
June.....	Tennessee	July 14.....	Pennsylvania
June 1.....	Missouri	July	Wisconsin
June 27.....	Connecticut	July 24.....	New York
July 1.....	Massachusetts		

Roguing and seed selection are generally reported by collaborators as giving the desired results. In the East the general appreciation of better and cleaner seed seems to have resulted in a decrease in the amount of the disease. In the north central section however, no such decrease is evident although much interest is manifested in good seed.

In Minnesota and Wisconsin corrosive sublimate seed treatment gave better results than formaldehyde. Newhall noted in Minnesota that farmers in the Red River Valley who habitually treated their seed with corrosive sublimate had remarkably clean fields with not over one diseased hill in every five or six thousand, while fields from seed that was treated with formaldehyde showed 5 to 15% black leg. He secured other evidence that pointed toward the general superiority of the corrosive sublimate treatment for black leg.

In Michigan Woodcock saw a field where fourteen rows of cut seed showed 7% diseased hills and two thirds of a stand, while forty-four rows of the same seed which was uncut showed only 1% black leg and a perfect stand.

Early Ohio is reported as more susceptible than other varieties from Minnesota.

Stem rot and scurf caused by Corticium vagum B. & C. var. solani Burt
Rhizoctonia solani Kuhn.

Rhizoctonia injury to potatoes was reported from all states but eleven in 1918. It undoubtedly occurred in every state however. The reports for South Carolina, Florida, Mississippi, Louisiana, Arkansas, and Montana are the first ever received from those states. There are no records in the Survey files of the occurrence of the disease in Kentucky, Tennessee, or Illinois.

Reports indicate that the disease was of only slight importance in the South but in some of the more northern states, from Pennsylvania and New York

westward to Washington, heavy losses were sustained. In New York where careful counts were made on about 3200 acres in 18 counties it was estimated that the crop was reduced about 5% on account of missing and diseased hills caused by Rhizoctonia. In addition many tubers carried sclerotia. Pennsylvania sustained losses about the same as New York.

In Michigan, where the disease has been a serious trouble for several years, it was common to find 15 to 25% of the hills worthless in fields where no seed treatment was given. The injury took the form of both stunted and missing hills early in the season and aerial tubers and rosette tops later in the year. Although the injury was manifest in about 40% of the fields, and was extremely severe in some places, still the aggregate injury for the state was not great. Counts made in 328 fields in 21 counties showed that only 16% of the fields sustained more than 1% loss.

In Wisconsin this was probably the most important potato disease in 1918. It was generally present everywhere in the state causing irregular stands and small tubers. It was found in 136 fields of the many examined by W. H. Wright in amounts ranging from 1 to 100%, average 14.7% affected hills.

In Iowa, Kansas, Wyoming, Colorado, Utah, Idaho, and Washington it was reported as being general and severe. In most of these states it ranked along with Fusarium wilt in importance and in Washington it was even more serious. In this state it was extremely bad and caused losses as high as 50% in some cases. No varietal susceptibility is reported.

Collaborators seem to be agreed that corrosive sublimate as a seed disinfectant is satisfactory and superior to formaldehyde. In a few cases, however, corrosive sublimate used at the commonly recommended strength was reported as giving questionable results.

Malnutrition (non-parasitic)

Malnutrition troubles were reported last season from most of the states along the Atlantic Coast from North Carolina to Maine. Definite reports were received from all the New England states, New York, New Jersey, Pennsylvania and North Carolina. A report from Minnesota also indicates its occurrence for the first time in slight amounts in sandy soil near Grand Rapids, Beltrami County. This is the first record received by the office of the occurrence of this trouble west of Pennsylvania.

For the past few years, and since the scarcity of available potash in commercial fertilizers has existed, potato plants have suffered in regions where fertilizers are usually used and where the soil is naturally somewhat deficient in available potassium. In the season of 1916 Edson and Schreiner[1] reported the condition in numerous eastern fields from Maine to Virginia. In 1917 the same regions were affected.

The trouble seemed to be worst on early potatoes. When these were planted on soils deficient in potash, a great deal of loss often occurred. In 1916 in Maine whole fields went down prematurely with the result that the yield was greatly reduced. In 1917 it was estimated that 10% reduction in yield occurred in the tidewater section of Virginia and 5% loss was reported from Vermont. In 1918 Vermont reported 5 to 10% reduction in yield and Connecticut 20% crop injury.

---

[1] Edson, H. A. & Schreiner O. A malnutrition disease of the irish potato and its control, Phytopath. 7 : 70-71. 1917

From reports at hand it appears that the disease was fully as bad in 1916 as any year. In 1917 reports from Maine and Connecticut state that it was not so severe as in 1916. Morse in Maine attributed this decrease to the fact that there was not so much hot, dry weather at the critical period of plant development. In 1918. the disease was less than in the year previous in Maine and Vermont, but in Connecticut, Massachusetts, and New York it was apparently more severe. The situation in Connecticut was very unusual, serious, and difficult to analyze. G. P. Clinton made a special study of the problem and came to the general conclusion that, "Lack of moisture and insufficient plant food, of which potash is one of the factors, were primarily responsible for most of the trouble, rather than fungi, poor seed, or insects (especially lice), all of which have been attributed as the cause". The reason for the decrease in some sections is probably because of the adoption by the farmers of remedial measures such as the use of the better soils for potatoes, the application of larger amounts of barnyard manure, and the purchase of better quality commercial fertilizers.

During the last year considerable has been said about a stem blight of potatoes caused by Phoma sp. The Survey has received reports of Phoma from the following states: - Maine ("The so-called Phoma stem-blight has been recognized in Maine since potash hunger first appeared in 1916. Phoma frequently may be found fruiting on plants that have gone down from lack of potash and never appears on similar plants growing along side which have received a potash fertilizer"), New Hampshire, Vermont (Rather commonly collected in potato fields), Massachusetts("General, while it is not fully determined that Phoma was the cause of much of the trouble attributed to it last summer, there is evidence that in restricted areas it was the primary cause of serious loss. It cannot be said with certainty that this disease is of economic importance"), New York (Very common on Long Island and also reported from other places in the state), Pennsylvania.

As is indicated in the above notations it is the general opinion that the occurrence of Phoma is tied up with that of malnutrition disturbances. The geographical range of the two diseases seem to be about the same and Phoma has been found for the most part on plants suffering from improper nutrition. Such plants are much more susceptible to the attacks of fungi that are normally considered saprophytic. In this connection it is interesting to note that reports of a tuber rot with which Phoma was found associated has been reported from Maine and New York in 1918, and from Michigan in 1915. The organism in the latter state was said to be only slightly pathogenic on potato tubers and was different from that described by Melhus from Maine.

Just how parasitic Phoma may be still remains to be determined. The evidence however seems to indicate that it is not a primary cause of disease and only attacks plants that are greatly weakened from certain causes.

Dates of first appearance of malnutrition and Phoma 1918.

	Malnutrition	Phoma
Me.	About Aug. 1, 1917 & 1918.	about Aug. 1, 1918.
N. H.		Aug. 29, 1918.
Vt.	Aug. 1, 1918	Aug. 8, 1918.
Mass.		July 10,1918, July 23, 1917.
Conn.	July 6, 1918	about July 6, 1918.
N. Y.	July 26, 1917	July 8, 1918.
Pa.		June 29, 1918.
Va.	Early May 1917.	
Minn.	Aug. 8, 1918.	

In Connecticut potatoes of the Rural type, particularly Dibbles Russet, appeared to be less affected by malnutrition than other varieties. Early sorts, such as Irish Cobbler, were worse affected.

Collaborators voice the opinion that the liberal application of manure and the use of the better soils for the potato crop are successful ways to avoid heavy losses from malnutrition troubles.

Mosaic (cause undetermined).

The range of mosaic appears to be limited only by the presence or absence of susceptible varieties. Thus Bliss Triumph has come to be regarded as inseparable from the disease and occurs in practically every field where this variety is planted. Indeed most growers are so accustomed to seeing mosaic diseased plants of this variety that they would be apt to fail to recognize a healthy plant if it could be shown them.

The Green Mountain, which probably ranks second of the commercial varieties in susceptibility, is also fast becoming affected, or at least growers everywhere are experiencing more and more trouble with the disease in this variety. It seemed to be the general opinion at a meeting of pathologists interested in potato mosaic at Buffalo August 16-17, that it was extremely difficult to find fields of Green Mountains free from the disease.

It therefore appears that a map of the United States representing the range of the Bliss Triumph and potatoes of the Green Mountain group would also show in general the range of mosaic.

In 1918 the disease was reported from the northern belt of states extending from coast to coast and including New England, New York, New Jersey, Ohio, Michigan, Wisconsin, Minnesota, North Dakota, Colorado, Montana, Washington, and Oregon; and from the southeastern group of states comprised of Tennessee, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, and Texas. From reports of years prior to 1918 the states of Indiana, Illinois, Virginia, West Virginia, and Idaho may be added to the list of those where the disease exists.

It is probable that it will occur in all parts of the country where affected seed is planted. From the reports at hand mosaic seems to be worst in the Gulf Coast States on Triumph where that variety is grown rather extensively for the early market and in New England, northern New York, Long Island, and New Jersey on Green Mountain and on Triumph.

The losses from mosaic are high in the states where the Green Mountain and Triumph varieties are popular, that is, the northeastern and southeastern sections. In Maine in 1916 it was estimated from 10% of the Green Mountain were affected and 50-75% of the Bliss. Since 1916 the disease has apparently not increased greatly in extent or severity. In New York 10% of the Green Mountain were said to be affected in 1915, 10-15% in 1916 and about 25% in 1918. In this state in 1917 it was so severe on certain parts of Long Island that fields of 15 to 30 acres were plowed up and individual farmers lost two to three thousand dollars. In Vermont the disease has not been rated of great importance until the last few years. In 1918 however it was said to be the most serious potato trouble in the state.

Although not many definite figures are available that show the losses for entire states in the South still the many isolated counts that have been made indicate that mosaic presents a very serious problem. In Florida in 1916 50% affected plants were reported in some cases, 30% loss in individual fields in 1917, and 25 to 30% in various regions in 1918. In Alabama 50 to 75% mosaic was observed in several fields in the Mobile section in the spring of 1918.

In this state and in parts of Mississippi it is reported that mosaic is so bad on Bliss Triumph that it is questionable whether or not the variety should be planted. In Arkansas 50% affected plants are reported from some places. In Louisiana it is mentioned as the most prevalent and destructive potato trouble in the Lafourche-Thibadaux region, 90% extreme mosaic reported in a number of fields in this section and 50% from Hammond County. Edgerton estimates 10-20% crop injury and 10% loss for the state. In Texas L. R. Hesler reported 25-50% on Triumph in the vicinity of Austin, 75% bad mosaic at Palestine, 2-5% at Eagle Lake, Colorado County.

It has been estimated* that on the average mosaic reduces the yield of potatoes about one-half, thus if 50% of the plants were affected the yield was probably reduced 25%, more or less, depending on the severity of the mosaic.

Practically all states mention Bliss Triumph and varieties of the Green Mountain group as most susceptible. American Giant is reported affected in New Jersey. Peerless (Alabama), Irish Cobbler (Georgia, Maine); and Spaulding Rose (Maine) are mentioned as showing resistance.

Leaf roll (cause undetermined)

Since pathologists do not have a common understanding as to what constitutes true leaf roll the reports that have been received concerning the trouble are necessarily somewhat confusing and not of great value.

The following states have reported a rolling of the leaves in 1918: Maine (Occasional), Vermont (Occasional, loss small, first reported in August), Massachusetts (General, 1% loss, first reported July 8, severe in some fields of Irish Cobblers), Connecticut (Much more common than usual, first reported July 2, variety Gold Coin badly affected), New York (Inspection made in 24 counties on 3,277 acres show 5.5% affected plants, with a probable average loss of 3.8% for fields inspected. This probably represents the loss for the state although, if anything, it is conservative because the fields inspected were among the best, diseased mostly in the blue sprout section of western New York), New Jersey (About the same as last year), Pennsylvania (General and probably more than usual, 50% of crop estimated affected. Dibble's Russet apparently very susceptible as it showed 95% in three different counties, Carman more resistant. Leaf roll is one of the most serious diseases in the state), Tennessee (General, 20% crop injured), South Carolina (Considerable), Georgia (Local, slight, loss small, first reported May 3, Irish Cobbler most affected), Ohio (Seen in a number of fields), Michigan (Apparently not very serious, disease is confused with Fusarium wilt, observed in both Upper and Lower Peninsula), Wisconsin (Slight amount, first reported in July), Minnesota (General, about as usual, probably less than 1% crop injury), Montana (About the average amount, 2-3% crop injury), Washington, Oregon (6% in one field), California (Reported from San Fernando Valley, in two fields average was about 50%).

In addition to the above states reports of leaf rolling have been received from Colorado (1913), Idaho (1913, 1915), Iowa (1916, 1917), Maryland (1915), Nebraska (1913, 1916), and Utah (1915).

Curly dwarf (cause undetermined)

Reports of a curly dwarf disease of potatoes have been received from a number of states. It is probable that in most cases the disease reported has not been

---

*Report of the conference on Diseases of potato and seed certification 1918: 5. 1918. Murphy, P.A. The economic importance of mosaic of potato Phytopath. 7:72 1917.

the true curly dwarf but dwarf mosaic, or possibly plants that are degenerated from other causes. Reported from Connecticut, Pennsylvania, Louisiana, Arkansas, Chio, Michigan (Common but not destructive until 1918, several fields in Emmett County showed more than 50% of hills affected, in one place where small seed was used 90% of curly dwarf hills were found. In general the disease was a minor factor in cutting down the yield of the crop), Wisconsin (Scattered, in some fields nearly half of plants may be affected), Minnesota (General, rather less than usual), Iowa (Prevalent but less common than last year), Montana (Occasional plants found affected), Washington.

In addition to the above states what was taken for curly dwarf was reported from the following states in years prior to 1918: California (1917), Florida (1915), Idaho (1913, 1915, 1916), Kansas (1917), Maryland (1915, 1916, 1917), Nebraska (1916, 1917), New Jersey (1915, 1916, 1917), New York (1914, 1915, 1917) and Oregon (1913, 1916, 1917).

Lightning injury (non-parasitic)

Lightning injury was reported in 1918 from New York, New Jersey, Pennsylvania, Michigan and Wisconsin.

Chas. Chupp reported that lightning injury was observed by the members of the department of plant pathology in 4 different fields in the western part of New York. In each case the area affected was about 1 square rod.

L. M. Massey reported plants killed in a circular area about 25 feet in diameter at Egg Harbor City, New Jersey. A witness thought lightning struck there.

Fifteen cases of lightning injury to potatoes were observed in various parts of Pennsylvania last year according to C. R. Orton.

E. F. Woodcock reported as follows from Michigan: "Four cases were observed in the state during the summer. All these were found in the Lower Peninsula and in separate counties. The affected spot in each case did not exceed two rods in diameter and was circular in form. There was no indication that the electricity had followed the rows. Evidence seemed to show that the injury radiated from a common center even though I was not able to locate any central spot where the soil had been disturbed by the bolt. In some cases practically all the plants had been killed, while in others some of the plants remained alive. The injury came so suddenly that the killed plants wilted down immediately without their tissues becoming browned. The stems usually were dry and blackened where the electric current had passed. The stem below the ground appeared to immediately undergo a dry rot. The new tubers, where formed, soon rotted in the ground. In some cases, where the plants were not entirely killed while still prostrate, they began to revive at the tip and this portion would become erect and develop in a normal way."

R. E. Vaughan reported five cases from as many different counties in Wisconsin. This is more than were observed in 1917.

Other earlier reports available in the Survey files are from Maine, Pennsylvania and New York.

W. J. Morse reported two cases, one at Caribou and one at Lagrange, Maine in 1917.

C. R. Orton reported as follows from Pennsylvania: - "An acre of potatoes in Montgomery County was observed to be destroyed from the effects of lightning. A severe electrical shower occurred at the time a portion of the field was flooded for a few hours. The lightning struck a tree at one end of this flooded area and ran down to the ground and over the flooded area. All plants in this area were killed.

The field was visited the following day." "In Armstrong County, Pennsylvania, a field was reported struck on July 21. Plants were killed in an area of about one rod in diameter".

M. F. Barrus and R. J. Haskell reported cases in Wayne and Franklin counties, New York, in 1914. "In each field the plants were all killed in an area of about 2 rods in diameter. In the case in Wayne County there was a shallow sag in part of the field where the bolt struck. The electricity had progressed along this more than in other directions as was shown by dead or affected plants in the low area".

Scab caused by Actinomyces scabies (Thaxter) Gussow.

Scab occurred last year as usual all over the United States. Within the various states it was for the most part general in its range but on account of such influencing factors as extent to which the crop is grown, popularity of seed treatment, character and type of soil, use of barnyard manure, crop rotation, other crops, varieties grown, etc., the disease varied greatly in severity in various sections. Thus in a number of states it is reported as being most serious in the older potato sections. Also in certain counties of states such as New York, Pennsylvania, Wisconsin, and Minnesota, where active seed treatment campaigns have been conducted by county agents, the disease is much less serious than in counties where the matter of seed treatment has not been brought to the farmers' attention,

In general the disease was reported as being about as prevalent as usual but decreases or increases are reported from different states. Minnesota and Pennsylvania report a reduction in scab due to the increased amount of seed treatment, while Massachusetts estimates an increase because of the more general use of barnyard manure as a substitute for commercial fertilizers.

The losses from scab are very great for the United States as a whole. In some states it is considered the most important potato disease. The losses are brought about by reduction in both quantity and quality of marketable tubers.

Table III. Percentages of tubers injured, and the losses sustained, on account of scab during the last two years as estimated by collaborators in various states.

	1917		1918	
	% Injury	% Loss	% Injury	% Loss
Vermont	10-15	5-10	---	---
Massachusetts	---	---	---	3
Connecticut	---	---	---	1-2
New York	---	---	6.4	1
Pennsylvania	11	---	20	5-8
Virginia	35 (Eastern Section)		---	---
Kentucky	10	---	---	---
North Carolina	5	---	---	---
South Carolina	5-90	10-20	30	2
Georgia	---	---	10-15	2-3
Florida	0-100	---	---	---
Louisiana	---	---	5-10	5
Texas	1/2	---	1/2	---

Arkansas	10			
Illinois		10-15		
Minnesota		($200,000)	1	($150,000)
Iowa	3			
Missouri			15	
New Mexico	10-30	1-10		

In Iowa the variety, Early Ohio, which was very badly affected in 1917, was said to be more susceptible than Rural New Yorker. This latter variety in Wisconsin and Russet Burbank in Minnesota are said to show resistance.

Most collaborators state that seed treatment with either formaldehyde or corrosive sublimate is satisfactory when potatoes are placed on clean land. There seems to be a tendency to favor corrosive sublimate as a seed disinfectant probably because of its superiority against other diseases. The following table gives an indication of the amount of seed treatment in various states.

Table IV. Extent of seed treatment of potatoes in various states according to reports of collaborators in 1917 and 1918.

State	Collaborator	Year	Extent of seed treatment.
Maine	W. J. Morse		Rather generally practiced and increasing in popularity through influence of county agents.
Mass.	A. V. Osmun		Almost universally practiced.
Conn.	G. P. Clinton	1917	More interest in seed treatment than ever before.
N. Y.	C. Chupp	1917	Possibly 30% seed treated annually.
Pa.	C. R. Orton	1917	Less scab each year as treatment is quite generally practiced by farmers and commercial growers.
Va.	J.A.McClintock	1917	Only rarely practiced at least in eastern section.
W. Va.	N. J. Giddings	1917	Practiced to a far greater extent than reliable spraying.
Ky.	F.T.McFarland	1917	Little practiced.
N. C.		1917	Many inquiries regarding method received.
Ala.	G. L. Peltier	1917	Most growers said to be treating.
La.	C. W. Edgerton	1917	Growers are beginning to treat.
Ark.	J. A. Elliott	1917	Very little practiced.
Ohio.	A. D. Selby	1917	
Wisc.	R. E. Vaughan	1917	Generally practiced in counties where county agents have made it a special project.
Minn.	Div. Pl. Path.	1918	Considerable increase and consequent reduction in amount of scab.
Iowa	I. E. Melhus	1917	Practiced by only an occasional grower.
Kans.	L. E. Melchers	1917	Not commonly used.
Wyo.	J. F. Groves	1918	Encouraged by county agents but not generally practiced.
Colo.	H. E. Vasey	1917	Practiced by all progressive growers.
Utah	P. J. O'Gara	1917	About 25% of the growers treat seed.
Wash.	F. D. Heald	1917	Practiced by large but not by small growers.
Oreg.	H. P. Barss	1917	Gaining in favor and practice is being extended.
Calif.	J. T. Barrett		The majority of potatoes, however, are not treated.

Powdery scab caused by Spongospora subterranea (Wallr.) Johnson.

It is interesting to note that powdery scab appeared in a private garden at Clemson College, South Carolina. On account of the warm temperature it is probable that the fungus will not flourish in South Carolina.

Wart caused by Chrysophlyctis endobiotica Schilb.

One of the most important events in the pathological field during the past year was the discovery of potato wart for the first time in the United States.

The disease was brought first to the attention of Prof. J. G. Sanders, of the Pennsylvania Department of Agriculture, about the middle of September when he received specimens from Highland, Pennsylvania. A survey made in the vicinity of Highland, from September 23 to October 7, showed the disease to be present in at least twenty-six small mining towns in Luzerne, Schuylkill and Carbon Counties. These places are included in an elliptical area about 12 x 18 miles in size extending from Upper Lehigh in Luzerne County to Beaver Meadows in Schuylkill County.

A somewhat detailed account of the Pennsylvania situation has already been given in this bulletin[1], in other publications[2].

Silver scurf caused by Spondylocladium atrovirens Harz.

This disease was only reported from New Hampshire, Ohio and Washington in 1918, although records of its occurrence in previous years are at hand from the following states: - Maine, New Hampshire, Massachusetts, Connecticut, New Jersey, Pennsylvania, Delaware, Maryland, Ohio, Michigan, Wisconsin, Minnesota, Iowa, Utah, Idaho, Washington, Oregon and California.

Stem end rot caused by Fusarium eumartii Carpenter.

Pennsylvania reported this disease as principally in the southeastern part of the state. When present it is liable to be more destructive than any other disease of potatoes. First reported July 19, Cumberland County.

Jelly end rot caused by Fusarium radicicola Wr.

Reported frequently in shipments from Idaho, Washington and Oregon. Field reports have also been received from Pennsylvania where it appeared locally in about the same amount as usual.

---

(1) Pl. Dis. Bul. 2: 197-199. 1918.

(2) Kunkle, L. O. Wart of potatoes: A disease new to the United States. U. S. Dept. Agr. C., T. & F. C. D. Circ. 6: 1-14. 1919.
Orton, C. R., and Kern, F. D. The potato wart disease. Penn. Agr. Exp. Sta. Bul. 156: 1-16. 1919.
Sanders, J. G. The discovery of European potato wart disease in Pennsylvania. Journ. Econ. Entom. 12: 86-90. 1919.

Black heart (non parasitic).

Reported from Connecticut (Probably more common than usual on potatoes in storage), Maine, New Hampshire, New York (A number of specimens received), Pennsylvania (Local, slight), West Virginia (Severe), Mississippi, Texas, Missouri, and Washington.

Net-necrosis (various causes).

Reports of a so-called net-necrosis have been received from the following states:- Maine (About the same as usual), New Hampshire (Sullivan, Grafton and Belknap Counties, first reported August 3), Vermont (Two to three percent crop injury, first reported in November), Massachusetts (General, 2% loss), Connecticut (One report), Pennsylvania (Local, less than usual), Washington (Reported from King County and said to be caused by low temperatures).

The condition of net-necrosis may result from a number of causes. There is nothing in the above reports to indicate the types of necrosis concerned but it is very probable that more than one factor is responsible. The fact that it is reported only from the extreme northeastern and northwestern parts of the United States seems significant.

Soil rot caused by Cystospora batata Elliott.

Reported on white potatoes from Delaware annually since 1915. In no case was it at all serious. The loss was negligible.

Mushroom root rot caused by Armillaria mellea (Vahl.) Quel.

This fungus has been reported to the Survey several times during the last few years. In no case did it cause any special damage, less than 1% crop injury in all cases and in most instances it was so rare as to be considered a curiosity. Four states have reported mushroom root rot as follows:- Michigan (1915), Wisconsin (1917), Washington (1917, 1918), and Oregon (1915, 1916, 1917).

Unusual tuber formation.

Contributed by Prof. Q. W. Waid.- "In Michigan for the last two or three years, we have been finding a good many cases where tubers have formed on the seed piece without any top growth whatever. In some fields as high as 50% of the seed pieces developed in this manner. In most cases, the percentage is much smaller, however. There apparently is some connection between this unusual development and another form of tuber growth which is very abnormal, namely, the formation of tubers as a part of the stem. At least three fields which were inspected this season showed a considerable percentage of this kind of growth. As a rule, there is but one potato stalk in a hill having this sort of tuber formation and only one tuber as a rule forms in a stalk. However, in a few cases two or even three tubers have been found as a part of a single slender stalk."

Streak (Cause undetermined).

Streak was commonly reported by field inspectors in 1918 from New York where it has been under observation for a number of years. There seems to be more than one type of streak. In Maine a disease of this nature has been observed in recent years and is being investigated at the United States Department of Agriculture field laboratory at Presque Isle.

In July, 1915, a streak disease was reported by O. A. Pratt from Idaho as general but apparently doing little or no damage, and in 1916 cases were observed and reported in eastern Virginia and northern Minnesota.

Spindling sprout (non parasitic).

Reported to the Survey as follows:- 1916, Ohio, Idaho, Washington; 1917, Pennsylvania (Mercer County), Maryland (Prevalent, 4% loss in state), Minnesota (Anoka County), Washington (King, Washington, and Benton Counties), California (Few cases); 1918, Connecticut (Unusually conspicuous, serious in a number of fields), Ohio, Washington (Pierce, Yakima and Whitman Counties), California (San Fernando Valley).

Sclerotium blight caused by Sclerotium rolfsii Sacc.

Occurred throughout the southern states. Definite reports came from Louisiana (Common, 1-5% injury in different fields, possibly 1% loss, first reported in May) and Texas (Traces found in every field examined in the vicinity of Brownsville, San Benito, Harlingen).

Chlorosis (probably non parasitic).

Reported from Yakima and Benton Counties, Washington. It was also reported from these same counties in 1916.

Stem blight caused by Phoma sp.

(See malnutrition, page 50).

Slimy soft rot probably caused by Bacillus carotovorus Jones.

In the inspection of potatoes at the various markets during the season of 1918 slimy soft rot was found to be present in shipments from the following states:- Alabama, Arkansas, California, Florida, Georgia, Illinois, Indiana, Louisiana, Maryland, Michigan, Mississippi, Missouri, Nebraska, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, and Virginia.

It is thought that organisms of the Bacillus carotovorus type attack potatoes under unusual conditions, such as water-soaked soil with high temperatures, the heavy rains at harvesting time in the South probably being responsible for the heavy infection with the resulting loss in transportation. It will be seen that the highest percentages of decay were found in shipments of south-

ern grown stock. The largest number of cars of potatoes originated in Florida, Texas, and Louisiana. Of the 51 cars shipped from Louisiana, 15 cars ranged from 22 to 90% and the remaining 36 cars averaged about 12% decay. The potatoes shipped from the other southern states mentioned averaged about the same percentage of decay as those from Louisiana, while the stock grown in the more northern and western states averaged 3-10% decay in most instances, an occasional car noted with a somewhat higher percentage.

TOMATO

Septoria blight caused by Septoria lycopersici Speg.

During 1918 blight was very severe along the Atlantic Coast states from New Jersey to Georgia and also in the Ohio Valley. It was found in Vermont, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Tennessee, Kentucky, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Texas, Oklahoma, Arkansas, Ohio, Indiana, Michigan, Wisconsin, Minnesota, Missouri, Nebraska, Kansas, Colorado, and New Mexico. It was reported not present in Massachusetts, Louisiana, and Montana. Septoria blight has been reported at previous times from all the states except Montana, Wyoming, Arizona, Utah, Nevada and Idaho.

In South Carolina and Minnesota there was more than the usual amount, while in Connecticut, New Jersey, Pennsylvania, Delaware, West Virginia, Ohio, and Wisconsin there was less. In Virginia it was severe as usual.

In New York Septoria blight was abundant, and in a few cases the vines were an entire loss because of this disease. In New Jersey it was practically impossible to find a single plant free from the disease in many fields and frequently every leaf on the plant bore one or more spots. In Delaware it was found in many fields in every district. The foliage was destroyed in three weeks from the time the ripening period commenced. Depending on the resistance of the variety and the fertility of the soil, the damage for Delaware varied from 25% to 75% loss with an approximate average of 35%. In Virginia it was the most prevalent and generally destructive disease of the tomato crop. In North Carolina it caused premature drying of vines in many patches. In Georgia there was often a 100% injury in individual gardens. In Alabama many fields were defoliated.

Reports from New York, Wisconsin, and Minnesota mentioned the fact that the lower leaves were almost always attacked the worst. In Texas it attacked the flowers, causing a considerable dropping of the blooms.

Favorable weather conditions were reported from Virginia (Abundant rainfall), South Carolina, Georgia (Occasional showers in northern part of state), Oklahoma, Minnesota, Colorado (Frequent rains). Weather not favorable was experienced in New Jersey (Dry), Delaware (Drought from May to August 15 in the vicinity of Viola), Wisconsin (Dry).

Dates of first appearance according to collaborators:

1917

Early spring....	Tennessee	July 15.....	Virginia
June.....	Maryland	July 16.....	Ohio
June 4.....	New York	August.....	Pennsylvania

1917 (continued)

June 24.....	Minnesota	Aug. 17.....	Maine
July.....	Oklahoma	Aug. 22.....	New Hampshire
July.....	Wisconsin		

1918

May 20.....	Virginia	July 1.....	Missouri
June.....	Oklahoma	July 1.....	Kansas
June 6.....	Mississippi	July 23.....	New York
June 20.....	Georgia	Aug. 6.....	Pennsylvania
June 30.....	Minnesota	Sept. 15.....	Vermont
July.....	Wisconsin		

Varietal susceptibility was noted in Pennsylvania where the variety Magnus seemed most susceptible in Luzerne County. In Delaware the Norton tomato was distributed by the Delaware Experiment Station in cooperation with the Bureau of Plant Industry. According to T. F. Manns, the foliage of this strain stood up well but it was found to be late in setting its fruit. The Greater Baltimore strain ripened more fruit in three weeks than did Norton in five weeks. The demonstration plots were transplanted the first week in June. The farmers like a variety which may be transplanted the last week in May and continued until the third week in June; a variety which will ripen from the middle of August to the last of September so that tomato land may be used for winter wheat or, in the southern part of the state, sowed to crimson clover and wheat. In New Jersey and Minnesota it was more serious on early tomatoes, Earliana being especially affected.

Spraying as a means of control is apparently effective as shown by the results obtained in various states where it was tried or practiced. In New Jersey striking contrasts were noticed between sprayed and unsprayed vines in demonstration plots. In Delaware spraying was probably practicted commercially only on one farm in the state (near Seaford). The owner claimed results. At Viola experiments were made with the following sprays:- (1) Bordeaux (4-4-50), three sprayings; (2) resin fish oil soap bordeaux; (3) resin fish oil soap copper sulphate. On account of the existing drought satisfactory and accurate results were not obtainable. In the vicinity of Newark where there had been some summer rains the spraying showed up to advantage. In Maryland extensive spraying projects on the eastern shore gave fairly good control. In Virginia a field sprayed once showed marked difference between sprayed and check plots. In Georgia and Alabama Bordeaux held the disease in check when used. Little or no control is said to be practiced in South Carolina, Texas, Wisconsin and Minnesota.

Fusarium wilt caused by Fusarium lycopersici Sacc.

Fusarium wilt was reported as occurring in greenhouses in Massachusetts, New York, and Pennsylvania, and out-of-doors in Connecticut, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Arkansas, Ohio, Missouri, Nevada and Kansas. In Wisconsin plants were artificially infected in the field and later partially recovered. Reports of Fusarium lycopersici were also received from Colorado, Utah and Nevada, but because of the possible confusion with some of the western blights

it is preferred to keep these reports separate until it is definitely established that lycopersici is the real cause. As will be noticed wilt is largely southern in its range although it causes serious losses as far north as New Jersey and Ohio. Its range, although wider, is somewhat coincident with that of bacterial wilt and, as the two diseases are much alike and are often present in the same fields, difficulty is experienced sometimes in distinguishing clearly between the two. The area of infested land seems to be increasing annually in many states.

In 1918 the disease was about as prevalent as usual although in Tennessee it was reported as less than normal. The greatest losses occurred in the southern Atlantic and Gulf Coast states and in Tennessee. Estimates are not available for the states bordering the Ohio River, but it is suspected as having been bad there. Losses by states are given elsewhere in this volume of the Plant Disease Bulletin. In Delaware, in the vicinity of Columbia, T. F. Manns made counts of infected plants. It was found that 10 to 25% of the plants were so badly diseased that they matured practically no fruit. The average for the state has been placed at 9%. In Georgia, Mississippi, Alabama, and Tennessee this was reported as the most important tomato disease.

Dates when wilt was reported as being first observed:

1917

April 24 (greenhouse)	Massachusetts	July 1.....	Delaware
May.....	Louisiana	July 12.....	Virginia
May 20.....	Mississippi	July 14.....	Pennsylvania
June 15.....	Tennessee	July.....	West Virginia
June 15.....	Ohio.	July.....	Arkansas
June.....	New Jersey	Aug. 1.....	North Carolina

1918

April 8 (greenhouse).	New York	June 1.....	Tennessee
May.....	Louisiana	June 11.....	Pennsylvania
May 25.....	Mississippi	July 2.....	Connecticut
June 1.....	Georgia	July 15.....	Virginia

The resistant variety distributed by the Department of Agriculture was reported as giving very satisfactory results by most states where used. For Georgia, where several pounds of seed were planted, J. B. Berry reported as follows: "The seed was distributed among some twenty-five agents and projects usually showed good results. In several cases the Norton was planted with other varieties and all but the resistant were destroyed. It was also noted that the wilt resistant stood the drought better than any other variety." Peltier, in Alabama, reported that the variety from the United States Department of Agriculture held up very finely. In Maryland about 1000 acres of resistant strains were grown with good results. In Tennessee the Tennessee resistant and Globe were used successfully. In Virginia Norton was very resistant, while Brimmer and Bonny Best were susceptible. In Pennsylvania Earliana was reported particularly susceptible. In Ohio progress was reported in breeding resistant strains of Bonny Best and Globe in cooperation with the United States Department of Agriculture.

Rotation of crops seems to be recommended in some states, although it is reported as not being very satisfactory as a means of control. One case was observed in Texas where an 8-10 year rotation was apparently successful, but many other fields were observed that showed no gain from a 4-5 year rotation.

Western blights caused by Fusarium spp.

Various blights of tomatoes, some of which may or may not be the same, have been reported from the western states. A disease thought to be caused by Fusarium lycopersici, was said to have caused heavy losses in certain early tomato sections of Utah. Some fields showed as high as 20% infection. In Nevada 5% loss from a similar trouble was estimated. The most damage was in the western portion bordering California. In New Mexico a blight that has all the characteristics of the disease that is reported from the extreme northwest, was reported as prevalent and very destructive. In many fields 50-100% of the plants were diseased. The fact that the Department of Agriculture wilt resistant variety, which was so successful in states where Fusarium lycopersici is abundant, did not stand up under the New Mexican disease, is added proof that the trouble in that state is not the true Fusarium wilt.

In California a wilt disease, thought to be caused by Fusarium was reported in the vicinity of Hayward and San Jose causing losses of from 60 to 90% in large fields. Whether or not this is the same as the so-called summer blight of California is not certain. Summer blight, however, was reported by D. G. Milbrath as very serious in the tomato section of Moneta, Los Angeles County, California, and common throughout central California in general.

The yellow blight described by Humphrey (Wash. Agr. Exp. Sta. Bul. 115: 1-21, 1914) was reported as serious all along the tomato growing region of the Columbia Basin, Oregon, and was said to be very prevalent across the boundary in Washington.

Early blight caused by Macrosporium solani, E. & M.

Early blight was reported from New Hampshire, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Delaware, West Virginia, Virginia, Kentucky, Tennessee, South Carolina, Florida, Mississippi, Louisiana, Texas, Oklahoma, Ohio, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Kansas and New Mexico. As will be noticed this was particularly an eastern disease and reports of past years show that it has been more abundant in the southern and eastern parts of the country, particularly the southeastern portion. In 1918 it was most severe in Florida and Louisiana, where many early tomatoes are grown. It was also reported as very bad in parts of Tennessee, Kentucky, Ohio, West Virginia and New Jersey.

The losses were heavy in some of the southern states. In Florida it is estimated that at least 30% of the crop was lost previous to shipment. L. R. Hesler reported the disease as exceedingly prevalent and destructive both in the East and West coast regions. It occurred in all fields, causing a severe spotting and premature dying of the foliage, especially the lower leaves. Growers and others agreed that at least 20% of the fruits were culled out at the pack-

ing houses on account of blight lesions, or "nail head spot" as it is commonly called. In addition to this loss many tomatoes were not picked because of the severe spotting of the fruit. G. K. K. Link reported the crop in many places in Florida ruined by early blight. One firm had to discard 40% of all tomatoes delivered at the packing house, mostly on account of "nail head spot". In Louisiana Mr. Neal reported that losses of 40-50% were observed in every field examined in Jefferson and St. Bernard Parishes where there are about two thousand truckers. The quality of tomatoes in these fields was said to be poor because of premature death of the vines.

In addition to the heavy losses that occurred in the field, large amounts of "nail head spot" were reported in shipments of early southern tomatoes to northern markets. The following table gives an indication of the amount of disease found by inspectors of the Bureau of Markets.

Table V. Extent of "nail head spot" as found by inspection of shipments at various northern markets.

Origin of shipment	No. of cars inspected	No. of cars with nail head	Percent affected fruit	Remarks as to seriousness of disease
California	31	2	1 car 6%	
			1 " 23%	Not extending deeply into fruit.
Florida	108	85	21 cars 30% up	More than half of decay in each car bad.
			9 " 20-30%	Most cars with 1 to 10 spots, some cars as high as 20 spots each fruit.
			27 " 10-20%	Averaging 1-5 spots to each fruit.
			22 " 2-10%	Mostly slight, a few spots each.
			6 " 1-2%	Occasional spot.
Georgia	1	1	15%	From 2-10 spots on each tomato.
Rhode Island	1	1	3%	
Tennessee	16	1	2.5%	Slight.
Mexico	11	1	---	A small amount of slight decay.
Origin unknown	7	1	8.5%	From 6-15 spots on each affected fruit, one-fourth inch in size.
Total	175	92	Average 12-15%	

Spotting of both fruit and foliage is said to be common in the South and up the coast to New Jersey but in the more northern states, of those reporting, the injury seems to be confined chiefly to the foliage. Clinton in Connecticut reported a spotting of the fruit as having been observed for the first time in the state. The disease was reported by collaborators as first appearing in 1917 and 1918 on the following dates:

1917

Jan..... Florida
March..... Mississippi
July 1..... Delaware
Aug. 3..... Ohio
Aug. 4..... New York
Aug. 20..... Minnesota
Oct. 1..... Pennsylvania

1918

May 30.....	Tennessee	July 28.....	Penneysylvania
June 15.....	Virginia	Aug. 3.....	New York
July 1.....	Missouri	Aug. 12.....	Connecticut
July 5.....	Massachusetts		

The disease was reported on Earliana and Early Belle in Connecticut, E arliana and June Pink in Louisiana, Ponderosa in Pennsylvania.

Bacterial blight caused by Bacterium solanacearum E.F.S.

Judging from the reports at hand bacterial blight was about as prevalent in 1918 as in 1917 but was apparently more widely distributed than in the year 1914, 1915 or 1916. It was reported from Virginia, West Virginia, Tennessee, North Carolina, South Carolina, Georgia, Florida, Porto Rico, Texas, Arkansas, Ohio and Colorado. It was reported as not present in Connecticut, New Jersey, Maryland, Alabama, Wisconsin, Missouri, Kansas, Kentucky, Louisiana, Oklahoma, Montana and Washington.

The greatest injury seemed to have taken place in the Carolinas and adjacent states. In Richmond County, North Carolina, some growers state that they can not produce the crop profitably on account of the disease. In South Carolina, it is reckoned as by far the most important tomato trouble. This is also the case in Porto Rico. Estimated losses of 1% or more are also reported from Georgia, Florida, Virginia, Tennessee and Texas. In the other states it appears to be of only slight importance.

Blossom end rot (non parasitic).

Blossom end rot seems to have been unusually severe in 1918. It appeared in thirty-one states from the Atlantic to the Pacific Coast, from the northern to the southern boundary. The trouble was general and very severe in New J arsey, Pennsylvania, Maryland, West Virginia, Kentucky (Epidemic), Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas, Ohio, Missouri, Nevada and Oregon. Reports were sent in from the following states for the first time, although its occurrence in these states is by no means new: New Hampshire (Local, moderately severe), Oklahoma (Local and very slight), Illinois (Local, moderately severe), Nevada (General and very severe). The only states in which tomatoes were grown and which have not reported blossom end rot are North Dakota, South Dakota, Montana, New Mexico and Idaho.

The losses were heavy in many states. In New York the Chatauqua district was so hard hit that the growers insisted that plant pathologists take some action. In Niagara County, New York, the growers also asked for assistance in combating the trouble. In Tennessee the crop was unusually free from the disease during 1918. In Alabama considerable loss occurred. In Mississippi blossom end rot was very common and the most important tomato disease in the large fields about Crystal Springs. In Texas it was second in importance to blossom drop. In Ohio it was more serious than ever before known. In Michigan total losses were experienced in some fields in the southern part of the state.

Table VI. Injury and losses to tomatoes from blossom end rot as reported by collaborators, 1918.

State	Percent fruit injury	Percent loss
Vermont	2 - 5%	2 - %
Massachusetts	---	possibly 1%
New York	5%	---
Pennsylvania	---	11%
Virginia	Very slight	Very little
Kentucky	50%	35 - 75%
Georgia	100% (locally)	15 - 20%
Mississippi	---	30 - 34%
Louisiana	---	probably 10%
Texas	10%	---
Oklahoma	1/2%	---
Arkansas	15%	20% (?)
Wisconsin	trace	trace
Missouri	10%	---
Kansas	100% (local)	---
Arkansas	1%	---
Nevada	10%	5%
California	---	15% (local)

Several possible factors were presented by various states as perhaps having influence in bringing about blossom end rot. The effect of moisture was noticed in Georgia during the growing season when the weather was warm with occasional showers; in Alabama it was extremely dry during May and June, and in Ohio the disease was thought to have been associated with drought conditions. Insufficient soil moisture in Oregon was connected with the appearance of the disease. It was considered an irrigation problem in Utah. In Massachusetts the trouble was severe where highly nitrogenous fertilizers were used. In New York blossom end rot was worse when the vines were tied up and a top dressing of nitrate of soda used than when the vines were not cared for. In Georgia it was greater when the vines were supported than when they were on the ground. In Mississippi, J. M. Beal examined one field of 4 1/2 acres of clay loam soil which had been fertilized in 1917 with stable manure, and the tomato plants given good cultivation, staked and pruned. The weather conditions had been ideal. This field showed 80-85% infection. Although this field was worse than any of the others examined, all showed over 20%. In other fields where crops were grown under different cultural and fertilization methods the tomatoes were equally affected. The effect of sudden weather changes was observed in Florida.

The dates of earliest recorded appearance were as follows:

May.....	Louisiana	July.....	Oklahoma
May 25.....	Pennsylvania	July 3.....	New York
June 1.....	Georgia	July 29.....	Kansas
June 1.....	Missouri	Aug.....	Wisconsin
June 6.....	Mississippi	Aug. 8.....	New Hampshire
June 20.....	Virginia	Sept. 10.....	Vermont

Bonny Best and Earliana were more resistant than Ponderosa, Stone, and New Globe (badly affected) under the same conditions in Pennsylvania. In Virginia Bonny Best was also more resistant than Stone but in Illinois the disease was reported to be prevalent on Bonny Best. All varieties were affected in Kentucky.

Late blight caused by Phytophthora infestans (Mont.) De Bary.

Late blight was apparently less prevalent than in 1917. It was reported from Delaware, Virginia, West Virginia, and Ohio.

In Delaware it was local in the vicinity of Rehoboth where two fields were badly blighted. In parts of Virginia it was prevalent in almost every home garden except a few that had been sprayed. In West Virginia it was moderately severe in Tucker and Fayette Counties and of slight importance in Randolph and Greenbrier counties. In Oregon the situation is given by H. P. Barss as follows:

"The presence of this disease in Multonomah County, while not reported in 1917 nor 1918, was noted in 1916 and in previous years. It has sometimes been quite abundant in the early fall in this section. The unusual absence of any considerable amount of cool and rainy or foggy weather in this region during the past two seasons has probably prevented its appearance to any extent of late, but there is no doubt of its positive presence within the state. No cross inoculations between tomato and potato have been attempted in the state, so there exists some little reason for speculation as to whether this strain which appears morphologically very like the potato mildew is actually identical." 12/10/18

Leaf mold caused by Cladosporium fulvum. Cke.

This disease was apparently much less severe and prevalent than in 1917. It was generally found in greenhouses although also in the field. It was reported in Massachusetts, New York, (Considerable injury) Pennsylvania, South Carolina, Florida, Porto Rico, Oklahoma, Ohio, Iowa (Often limiting factor in commercial greenhouses where control methods are not practiced), Minnesota (Yield reduced 30% in Hennepin county), Nebraska, and Oregon (One report of serious damage to greenhouse tomatoes in Coast Region).

Buck eye rot caused by Phytophthora terrestria. Sherb.

This disease has been reported at various times during recent years from the southern states of Florida, Louisiana, Arkansas, and Texas, also Porto Rico. In 1918 reports were received from all these states. Judging from these reports the disease was worst in Florida. In Louisiana it was said to be severe on the lower fruits in the market gardens in the vicinity of New Orleans. For the state as a whole it was not serious, however. In Porto Rico the rot is common and attacks other vegetables, especially beans. The rot was reported in shipments of tomatoes from Florida and Texas. Inspection of seven cars of Florida tomatoes in northern markets in the spring of 1918 showed an average of from 3 to 6% buck eye rot and inspection of 5 cars of Texas tomatoes showed 2 cars with 14 and 18% disease

Grand Rapids disease caused by Aplanobacter michiganensis E. F. S.

This disease was first reported by Dr. E. F. Smith in the summer of 1909 as prevalent and doing considerable damage in the vicinity of Grand Rapids, Michigan. He also reported it as occurring on tomatoes in 1912 in a greenhouse at Arkport, western New York, and expressed the opinion that it was prevalent in other parts of the United States. Since 1912 it has been collected at various times in Michigan and specimens from New York and Indiana have been seen by the writers.

The disease was reported from Pennsylvania in 1918. It is stated that 50% loss resulted in two fields, one in Erie County and the other in Luzerne County, during that year. Chalk's Early Jewel and Earliana were affected, the latter more seriously. Red Rock was diseased to a slighter extent.

This trouble is not well known and is undoubtedly confused with other tomato diseases so that authentic survey data are not readily obtainable.

Mosaic (cause undetermined)

Mosaic was found in New York, New Jersey, Pennsylvania, Delaware, Georgia, Florida, Louisiana, Ohio, Illinois, Wisconsin, Minnesota, Missouri, Kansas, and Oregon. Reporting the disease for the first time were Georgia, Louisiana, Wisconsin, Missouri, Oregon, and California.

In New York there was considerable locally. In New Jersey the disease followed a bad infestation of aphids during July and early August, but there appeared no actual reduction in yield. In Pennsylvania the fern leaf stage was about the only dangerous form of the disease found in the fields. It was general but less prevalent than in 1917 and caused a 2-3% loss. In Delaware it was quite common in the early summer but apparently was not so bad as usual. In Florida all stages of the trouble were found on the foliage. Though second to early blight in prevalence its damage was negligible. In Louisiana it was very common causing considerable injury. In Ohio, Illinois, Wisconsin, Minnesota, and Missouri it was unimportant. In Kansas, mosaic was general and severe. In Oregon it was general, very severe, and worse than ever before.

A few plants in a greenhouse at Cudahy, Wisconsin, were reported to have shown marked resistance to the disease. The grower felt that the trouble was induced by unfavorable growing conditions while the plants were young.

Soft rot caused by bacteria.

Rather high percentages of decay were noted in eighteen cars of tomatoes from various states. Three of these cars were shipped from Florida in June, the decay in one car was slight, and another shipment had 22% of contents worthless from soft bacterial decay. In one small lot of eleven crates the tomatoes had sunk to half the depth of the baskets.

Two cars of Mississippi tomatoes showed rather heavy decay, one car containing 22% of worthless stock, the other car having 15% of fruit affected.

Seven cars of Pennsylvania tomatoes were inspected in August and were very badly diseased, decay ranging from 63% to 82%.

One car of tomatoes from Rhode Island was noted as having some bacterial decay with other rots but no definite report was made as to the exact percentage of any of these rots.

Three cars of Tennessee tomatoes showed varying amounts of bacterial soft rot, one car inspected at Atlanta in July averaging 33% soft rot, the other two cars inspected at northern markets ranging from 5% to 11% decay.

Cuban tomatoes were somewhat infected, one car showing 5% to 7% decay, the other car 15-20%.

Phoma rot caused by Phoma destructiva Plowr.

Table VII. Amount of Phoma rot as shown by market inspection at the various northern markets during the season of 1918.

Origin of shipment	No. of cars inspected	No. of cars with Phoma	Percent affected fruit	Remarks as to seriousness of decay
California	31	4	2 cars, 3-4%	Present in spots.
			1 car, 25%	Decay in cracks around stem end.
			1 " 80%	Ranging from small spots to total decay.
Florida	108	62	15 cars 20-50%	Bad decay, some complete decay.
			21 cars 10-17%	Mostly in spots, a few cases bad.
			26 " 5-8%	From 3 to 8 spots to specimen.
Mississippi	12	2	2 " 5%	
Missouri	4	1	Occasional	Slight.
Rhode Island	1	1	----	Combined with other diseases.
Tennessee	16	4	4 cars 5%	Various stages, from 0 to 20%.
Texas	23	1	1 car 14%	From slight to 35%.
Cuba	5	1	1 car 20%	10% bad decay, 10% in spots.
Mexico	11	8	3 cars 3-6%	In spots.
			2 " 10-20%	Small to large spots.
			1 car 40-45%	
Origin unknown	7	3	1 " 50%	Affecting half of fruit.
			1 " 26%	In spots.
			1 " 3%	From 6 to 15 small spots each.
Total	218	87	Average 15%	

Leak or soft rot probably caused by Rhizopus nigricans Ehr.

Leak or watery soft rot seriously affected tomatoes in twenty-six cars from Florida. Several cars averaged as high as 20-34% but most cars ranged from 5 to 10%. In all cases the affected tomatoes were totally decayed.

Three cars of Mississippi tomatoes were found to be affected, two of them averaging from 19% to 26% decay, the other car 2%.

Missouri tomatoes averaged 7% soft rot. One car from Tennessee showed from 25 to 30% Rhizopus rot. Small amounts of leak were found in four cars of Texas tomatoes, but in no case was there more than 5% decay.

Soil Rot caused by Rhozoctonia solani Kuhn.

Severe soil rot infection was noted in three cars of Florida tomatoes, 20% and 22% infection being found in 2 cars. In the other car only 3% soil rot was present.

Rot caused by Sclerotinia libertiana Fckl.

This decay was found to be present in only two cars of tomatoes from Florida, averaging 4% and 10% respectively. The affected tomatoes were soft and watery.

BEAN

Bacterial blight caused by Bacterium phaseoli, E.F.S.

Bacterial blight was reported from all but the following states in 1918: Delaware, Maryland, North Carolina, Alabama, Mississippi, Iowa, South Dakota, Nebraska, Wyoming, Utah, Nevada, Idaho, Washington, and California. This does not mean that the disease did not occur in the states named. It probably was present in most cases but no reports of occurrence were received. In past years blight has been reported to the Survey from all states except Wyoming, Nevada, Utah, and Kentucky. The disease was less prevalent than in 1917 in Minnesota, Oregon, Vermont, and Oklahoma and more prevalent in Colorado (where it was exceptionally severe), Louisiana, Tennessee, and Maine.

The highest percentage of loss occurred in the following states in order of importance: Colorado, Tennessee, Louisiana, New York, Pennsylvania, Virginia, Texas, Minnesota, and North Dakota. In Colorado, the fourth largest dry bean producing state, the disease was epidemic in the bean districts where 40-60% of the crop was injured with a decrease in yield of about 35%. In New York, which produced about 1,660,000 bushels of dry beans in 1918, or nearly one eleventh of the total yield in the United States, it is estimated that from 5 to 10%, with a possible average of 7%, or about 125,000 bushels of beans were lost. In Montana this disease is said to have been the most important bean trouble.

The blight is said to have affected principally the leaves and stems in Massachusetts, New York, Pennsylvania, Virginia, Michigan, Minnesota, and Texas. In other states, such as Colorado, Louisiana, West Virginia, and Wisconsin, it was equally severe on the pods. From Montana, Colorado, Oregon, and New York considerable trouble with stem girdling was reported. In the first two named states much loss was caused by the breaking over of the plants because of deep lesions at the point of attachment of the cotyledons. In Connecticut a wilt of seedlings is reported which may possibly be caused by the blight organism.

Dates when bacterial blight was first observed by collaborators in 1917 and 1918.

1917

April..... Louisiana	July..... Arkansas
April..... Maryland	July..... Wisconsin
May..... Alabama	July..... Colorado

1917 (continued)

June.....	Oklahoma	July.....	Oregon
June 1.....	Delaware	July 9.....	New Hampshire
June 2.....	Minnesota	July 15.....	New York
June 5.....	Vermont	Aug.....	Pennsylvania
June 13.....	Tennessee	Aug. 1.....	Michigan
June 25.....	Massachusetts		

1918

April.....	Texas	July 1.....	New York
April (last)...	Louisiana	July 2.....	New Hampshire
June 2.....	Minnesota	July 25.....	Colorado
June 4.....	Kansas	July 25.....	Pennsylvania
June 10.....	Tennessee	July.....	Wisconsin
June 20.....	Virginia	Aug. 24.....	Georgia
July.....	Oklahoma		

The varieties Navy Pea in Minnesota and Tennessee and Red Kidney in New York, were reported as especially susceptible, while Pinto beans in Colorado and the variety of shell bean known as Great Northern in Montana were reported as resistant. According to reports the latter variety has never been found affected in Montana.

Anthracnose caused by Colletotrichum lindemuthianum (Sacc. & Magn.) Bri. & Cav.

Taking the country as a whole anthracnose was less severe in 1918 than in 1917 or 1915 which were anthracnose years. However it was more prevalent than in the years 1913, 1914, or 1916. Certain individual states, such as Vermont, Virginia, and Colorado, reported the disease as more severe than in 1917 but the majority of them, particularly Maine, Massachusetts, Connecticut, New York, Pennsylvania, and Louisiana, reported it as less destructive. The disease was apparently worst in northern New England, Pennsylvania, Delaware, Virginia, West Virginia, Tennessee, some of the Gulf Coast regions and certain areas in the North Central States. It was of minor importance in the South Atlantic States and rare or absent in states west of the Missouri River. Colorado seems to have experienced more trouble with the disease than is usually the case.

The highest estimated percentage of loss was 18% from Maine. In that state from 20 to 30% of the crop was reported injured. In Vermont and New Hampshire losses of about 10% were sustained. In Mississippi, J. M. Beal estimated the loss for the state at 5% and reported that the county agent of Harrison County estimated a damage of 10% for that county. The disease is also reported as causing a great deal of trouble in green bean fields in the vicinity of Crystal Springs, Mississippi, the largest trucking center in the state. The green bean crop in Alabama, Louisiana, and Tennessee is thought to have been reduced about 3%, 3%, and 6% respectively.

Anthracnose was reported as first being noticed in 1918 as follows:

May 15.....	Florida	June	Maine
May 6	Louisiana	July 1.....	Missouri
May 7	Texas	July 1.....	Colorado
May 15.....	Massachusetts	July 8.....	Alabama

June 6.....	Tennessee	July 12.....	Illinois
June 6.....	Mississippi	July 21.....	Pennsylvania
June 10.....	Michigan	July.....	Oklahoma
June 11.....	Minnesota	Aug. 6.....	New Hampshire
June 15.....	New York	Aug. 15.....	Wisconsin
June 28.....	Virginia	Aug. 20.....	Georgia

Late planted beans were most affected in Pennsylvania, due perhaps to weather conditions early in the development of the plants. The Hodson Wax in Virginia, White Kidney in Maine, Wells Red Kidney in New York, and Kentucky Wonder and corn field bean in Georgia were said to show resistance, while the Yellow Eye in Maine was reported as especially susceptible.

The use of home grown seed in Louisiana is reported as giving excellent results. Selection of seed from disease-free plants or pods, and also the use of resistant strains is reported as giving satisfactory results where practiced in New York.

Mosaic (Cause undetermined).

Mosaic was reported from New York, Virginia, Arkansas, Indiana, Illinois, Michigan, Kansas, Washington, Oregon, California, and for the first time from Massachusetts, Connecticut, New Jersey, Pennsylvania, Tennessee, South Carolina, Georgia, Florida, Louisiana, Texas, Wisconsin, and Idaho. It was reported as not found in Maine, New Hampshire, Mississippi, Missouri, Wyoming, Colorado, New Mexico, and Nevada.

In importance the disease is rapidly becoming a close rival of bacterial blight, and evidence indicates that it was more serious than anthracnose in 1918. The estimates of losses range from a trace to 5% in Tennessee, 8% in New Jersey, 15% in New York and Pennsylvania, and 20% in Oregon.

In the commercial dry bean section of western New York, where a rather careful survey was made by Reddick and Burkholder, it is estimated that from 15 to 20% of the plants were affected. According to these observers, almost 50% of the pea and medium beans were injured in this section where these varieties include about half of the crop. The estimates were based on observations on 863 acres in 103 fields, in nine counties.

Rust caused by Uromyces appendiculatus (Pers.) Lev.

Rust occurred as usual chiefly in the eastern portion of the United States. It was reported from California and all states east of Colorado and Wyoming except Minnesota, Iowa, Mississippi, North Carolina, New Hampshire, and Vermont.

It was apparently most severe in Virginia, West Virginia, Tennessee, Louisiana, and was bad in southern Ohio. In these states it seems to be one of the important bean diseases. The losses were heavy on certain varieties but in general the loss for any one state was slight. In Georgia 10% loss is reported in individual fields but only about 1% for the state as a whole. In Louisiana the loss was heavy on susceptible varieties but slight for the entire crop. In Tennessee it is estimated that the disease injured half of the crop and is increasing in amount from year to year. In Virginia rust was reported in some fields, causing 100% injury. The loss for the state is put at 10%. In Colorado the yield was reduced not over 2% on account of rust.

There seems to be a relation between the amount of injury and the stage of the host. Thus in the northern states the rust usually appears too late in the season to do much damage. In the Virginia, Tennessee area it seems to attack the pole and shell beans early enough to seriously reduce the yield while the snap beans are often mature before much injury takes place. In the states further south it seems to do the most damage to the later maturing beans.

Dates when rust has been reported to have been observed:

1917

June.....	Louisiana	Aug. 1.....	Massachusetts
July 6.....	West Virginia	Aug. 1.....	Virginia
July 15.....	Michigan	Aug. 4.....	New Hampshire
July (late)...	Alabama	Aug. 8.....	New York
July (late)...	New Mexico	Sept. 1.....	Maine
Aug.....	Tennessee	Sept. 1.....	Indiana
Aug.....	North Carolina	Sept. 1.....	Colorado
Aug.....	Texas	Sept. 12.....	Pennsylvania

1918

May.....	Louisiana	Aug.....	Wisconsin
July 1.....	West Virginia	Aug. 11.....	Connecticut
July 1.....	Tennessee	Aug. (late).....	Maine
July 1.....	Georgia	Sept.....	Oklahoma
July 1.....	New Mexico	Sept. 1.....	New York
July 10.....	Virginia	Sept. 16.....	Pennsylvania

Pole and navy beans were mentioned most frequently as being susceptible. The following list shows varietial susceptibility as it was reported in 1918.

Affected	Not Affected.
Pole beans: (Conn., N.Y., La.)	Pole beans:
Kentucky Wonder (Me., Mass., Va., Calif.)	California Cranberry (Me.)
Crease Back (Me.)	Horticultural Pole (Me.)
Case Knife (Conn.).	
Bush beans:	Bush beans:
Navy Pea (Va., Ala., La.)	Long-podded Forcing (Me.)
White Kidney (Tex.)	Long-podded Green (Me.)
Lady Washington (Me.)	Horticultural Bush (Me.)
Stringless Green Pod (Me.)	California Red Kidney (Me.)
Colorado Pinto (Me.)	California Black-eye (Me.)
Idaho Small White (Me.)	Lady Washington (Calif.)
California Pink (Texas, Calif. Me.)	

Dry root rot caused by Fusarium martii var. phaseoli, Burkholder.

In New York, where the disease has been serious for some years, it continued destructive in 1918. It was most prevalent as usual in the western part of the state where large quantities of dry beans are raised annually. Apparently the continued cropping of the land to beans in this section has

resulted disastrously. The disease also occurred in northern New York to some extent. The accompanying map shows the approximate known range of dry root rot in New York.

Observations by D. Reddick and W. H. Burkholder in 103 commercial bean fields in 9 counties in the western part of the state showed the disease to be present in amounts ranging from a trace to 15% with an average of 5-10%. In this section at least 50% of the fields showed diseased plants. In Schuyler and Livingston Counties C. Chupp found the disease to be affecting nearly 25% of the plants on the average. It was estimated that for the state as a whole the loss would range from 5 to 10%, or from 72,000 to 145,000 bushels.

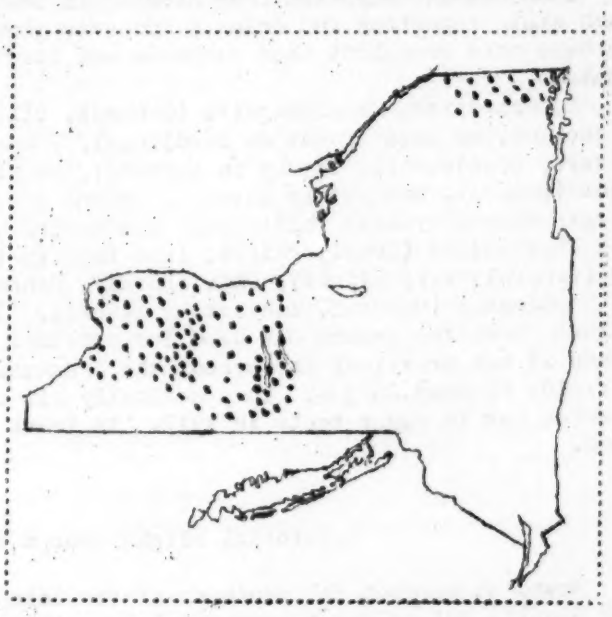

Fig. 5. Approximate known geographical range of bean dry root rot in New York. (After map prepared by C. Chupp.)

Dry root rot has not been reported definitely to the Survey from other states in 1918 but other states, such as Colorado, Michigan, Vermont, Virginia, Mississippi, Louisiana, and Florida have reported trouble with stem and root rots of uncertain causes. The extent to which Fusarium martii var. phaseoli is responsible is not known. An effort should be made to learn more about the range and losses caused by this fungus. Specimens should be sent to the Plant Disease Survey, or to W. H. Burkholder, New York State College of Agriculture, Ithaca, New York.

Powdery Mildew caused by Erysiphe polygoni De C.

Reported from Texas by J. J. Taubenhaus in several counties but unimportant, and by L. R. Hesler from San Benito. Reported from California in the fresh vegetable district and also in Ventura County, the dry bean district, where Kentucky and California Pink varieties are more susceptible than Limas or Lady Washington. Common in Porto Rico on mature plants but causing little harm.

Downy mildew caused by Phytophthora terrestria Sherb.

Reported by J. A. Stevenson as very destructive in parts of Porto Rico where entire gardens are often ruined. The occurrence of this fungus on beans is interesting as this is the first report to the Plant Disease Survey of its being parasitic on this host. Heretofore it has been reported only on tomato.

Stem rot caused by Rhizoctonia solani Kuhn.

Stem rot was reported from almost all sections of the country. General in each state reporting and doing a moderate amount of damage. The disease is perhaps more prevalent than supposed and its importance frequently underestimated.

Reported from Massachusetts (General, slight), New York (General in bean section, no loss except on seedlings), Pennsylvania (Scattered, moderately severe, considerable injury in gardens), Maryland (Local), Georgia (Local), Florida (General, moderately severe . Beans grown on soil that was said to be virgin showed typical rhizoctonia blackening of stems just below the ground line), Mississippi (Local, slight, less than 1% loss), Louisiana (Slight), Texas (General, very slight), Ohio (Local), Minnesota, Colorado (Local, moderate), Washington (General, moderately severe). In Florida it was especially prevalent where the ground was used for potatoes the previous year. In Colorado it was prevalent throughout the Arkansas Valley where the losses in some fields reached 20-30%. In practically all cases the disease appeared on land which was in sugar beets in 1917. In Texas a loss of about 2% is estimated.

Sclerotial blight caused by Sclerotium rolfsii, Sacc.

Found throughout the southern states doing a moderate degree of damage though usually not of great commercial importance. Reported from Georgia (General, doing 10% injury in individual fields. An estimated loss in state of about 5%. Earliest report of disease, May 10), Porto Rico (Several reports), Alabama (Found repeatedly in southeastern section), Mississippi (Locally, appears to be of importance), Texas (General over Cameron County on May 7th and 8th, plants were noted in all stages of development of the trouble).

Watery Soft Rot caused by Sclerotinia libertiana, Fckl.

In the inspection of products at the various markets during the season of 1918 Sclerotinia rot was found to be present in shipments of green beans from Alabama, Florida, Georgia, Louisiana, Maryland, Mississippi, North Carolina and Texas, the largest shipments coming from Louisiana.

Of the twenty-six cars of beans coming from Louisiana, watery soft rot was present in thirteen cars. In most of these cars about 10% of the beans were affected. Beans in a few cars averaged as high as 50% infection.

Twelve cars of Mississippi beans were inspected and Sclerotinia infection was noted in the contents of five cars, the decay being variable, one car with half of contents affected, the other cars showing less decay.

In the shipments coming from the other states mentioned Sclerotinia rot was present in but few cars, the beans from Georgia, North Carolina and Texas being more heavily affected.

It was noted that the decayed beans in all cases were nested in a heavy growth of white mold and the decay was heaviest at top of load.

Rot caused by Botrytis sp.

Gray mold was present in shipments of green beans from Georgia, Louisiana, Mississippi and Texas. In one car of beans from Texas 75% of the beans were covered with gray mold; Georgia beans ranged as high as 50%. Beans coming from Louisiana and Mississippi were not so heavily decayed, averaging about 10%.

Root and stem rots caused by Fusarium spp.

Reported for the first time from Virginia, South Carolina, Wisconsin, and Colorado. This disease is scattered throughout the United States, usually general and at times of a very severe nature. Reported from Massachusetts (General, very slight), New York (General, especially in western section. (See dry root rot, page 73-74) Loss ranges from 5 to 10%), Virginia (First report, one record in Campbell County, where entire crop was injured), South Carolina (First report, common over entire state), Louisiana (Very common, large percent of crop injured, estimated loss about 5%, earliest appearance April 6), Wisconsin (First report, very limited, only found at Madison. Crop injury very slight, no special search was made.), Colorado (First report, scattered. Injury 8-12%, estimated loss 5% for state. Earliest report July 22).

Rot caused by Rhizopus sp.

In two cars of beans, one each from Mississippi and Louisiana, an occasional moldy nest of decayed beans was found. Reported also from Oregon (green beans in market).

Sunscald (non-parasitic)

Sunscald was reported serious and general in both Pennsylvania and Michigan. In the Lower Peninsula of the latter state the injury was said to be widespread on the leaves. In this region its presence was due to the fact that most of the section had suffered from drought during the growing season. According to E. F. Woodcock, 63% of the fields observed showed the injury present. Thirty-six percent of the affected fields showed it in amounts of over 1%. In one case in Grand Traverse County 50% injury was observed on Robust Pedigree while on the same farm, under similar soil and cultural conditions, another field of ordinary field beans showed only 15% injury due to sunscald.

Other diseases and injuries

Texas root rot caused by Ozonium omnivorum Shear was of minor importance. It was reported from Texas (Restricted locally, 1% estimated loss), Oklahoma (Found in a small garden patch).

Black root rot caused by Thielavia basicola (B. & Br.) Zopf. was present in New York, especially in the lower tier of counties in western part of state. The injury was very slight.

Leaf spot caused by Phyllosticta phaseolina Sacc. was reported from Texas, Michigan (Local and unimportant). Not observed in Ohio, Wisconsin, New Jersey, Minnesota, and Louisiana.

Leaf spot caused by Cercospora sp. was reported from Porto Rico (Occasional), Texas (Caused an estimated loss of 2% of the crop in restricted areas).

Leaf spot caused by Alternaria sp. was reported from Louisiana (Specimens on pole and bush beans collected in the vicinity of New Orleans).

Leaf and pod spot caused by Diaporthe phaseolorum was reported from New Jersey (Rather less abundant than in 1917.)

Leaf and pod blight caused by Phoma sp. was reported from Ohio.

Gray leaf blotch caused by Isariopsis griseola Sacc. was reported from Connecticut (One report from New Haven County). In Porto Rico it was widespread, especially serious as a cause of defoliation and pod spotting of certain varieties.

Frost injury was reported from Washington (Severe in Whitman County, moderately severe in Pierce County).

Chlorosis was prevalent in Texas where it was estimated as causing a loss of 1%. Taubenhaus expressed the opinion that the trouble may be induced by an excess of lime.

Root knot caused by Heterodera radicicola (Greef.) Mull. was reported from Arkansas and Alabama.

ONION

Smut caused by Urocystis cepulae Frost

Smut was reported in 1918 from Massachusetts, New York, New Jersey, Pennsylvania, Tennessee, Ohio, Iowa, Colorado and Oregon. In years prior to 1918 it has been reported to the Survey from the following additional states: Maine, Connecticut, Delaware, West Virginia, Kentucky, Indiana, Illinois, South Dakota, Kansas, Alabama, Texas and Arizona.

For the most part the disease was localized in the regions of most intensive onion culture. Thus in Massachusetts it was most prevalent in the Connecticut Valley and Boston districts; in New York it was found in all the important onion growing sections especially in the black land meadows of the Wallkill River in Orange County, and in Wayne County; in New Jersey it was most serious in Warren and Burlington Counties; while in Wisconsin it was found principally in Racine and Kenosha Counties.

The highest loss was reported from New York where it is estimated that 15% reduction in yield of marketable onions took place. In the Wallkill Valley onion section of New York numerous counts were made in 23 fields and nearly half the onions were found to be diseased. The extent of the injury ranged from killing of the plants to smutting of the base of the outer leaves. In 1917 the loss in this county (Orange) was placed at 2 to 10%. The loss for Massachusetts was estimated at 2% altho in local instances as high as 25% infected plants were observed. In New Jersey one field was observed in Burlington County with 50% affected plants, while in Pennsylvania, Wisconsin and Oregon 40, 75 and 90% respectively were observed in local instances. At Racine, Wisconsin, untreated fields showed 5 to 75% (average 35%) smutted plants. In 1917 losses were reported as follows: Ohio, 15 to 20% disease in infested fields; Illinois, 25% crop injury and 10 to 15% loss; Oregon, $25,000 loss.

The accompanying table has been compiled from data contributed by I. C. Jagger, J. C. Walker, H. W. Dye, E. W. Olive, C. R. Orton, A. V. Osmun and others.

Table VIII. Results of experiments and demonstrations in the control of onion smut by the formaldehyde drip method.

State	Reporter	Treatment		Results					
		Strength of solution (gallons water used with 1 pint formaldehyde).	Amt. per acre (gallons)	Percent infected plants		Yield (bushels per acre)			
				Treated	Untreated	Treated	Untreated	Increase	
Mass. 1918	Osmun, A.V.	9.4	-		Not very satisfactory results:				
		16	50		" "	"	"		
N. Y. 1917*	Jagger, I.C.	21.875	250	11.1	88	487	28	459	
		21.875	200	15.9	88	461	28	433	
		21.875	150	18.3	88	395	28	367	
		21.875	100	30.3	88	308	28	280	
		18.75	250	5.3	88	500	28	472	
		18.75	200	8.3	88	508	28	480	
		18.75	150	7.2	88	487	28	459	
		18.75	100	17.6	88	397	28	369	
		15.62	250	1.0	88	491	28	463	
		15.62	200	4.1	88	495	28	467	
		15.62	150	4.4	88	491	28	463	
		15.62	100	10.8	88	454	28	426	
		12.5	250	3.2	88	464	28	436	
		12.5	200	0.8	88	473	28	445	
		12.5	150	1.7	88	440	28	412	
		12.5	100	7.6	88	417	28	389	
		9.375	250	2.6	88	439	28	411	
		9.375	200	4.4	88	455	28	427	
		9.375	150	0.9	88	446	28	418	
		9.375	100	4.1	88	444	28	416	
		Check plots(10)	-	(aver)	88	(aver)	28		

N. Y. 1918	Olive & Dye	16	225		1-7	28-38	816	514	302
		10	200		1	28-38			
	Dye, H. W.	16	200		10	49	826	447	379
		16	200		2	37	846	495	351
		16	200	approx:	-	-	555	261	294
		16	200	"	-	-	423	165	258
Penn. 1917	Orton, C. R.	16			10-15	90.0	553	374	179
1918		4			10-15	90.0	586	287	299
Wisc. 1913	Walker, J. C.	32	118		27.5	24.0	341	320	21
		16	118		5.6	24.0	506	320	186
		8	118		2.6	24.0	588	320	268
1914		16	118		13.4	51.2	344	86	258
		8	118		10.3	51.2	283	86	197
		4	118		11.5	51.2	216	86	130
		16	236		10.2	51.2	396	86	310
		8	236		6.2	51.2	409	86	323
		4	236		6.3	51.2	299	86	213
1915		16	118		28.6	52.6	632	400	232
		8	118		15.4	52.6	722	400	322
		16	236		3.6	52.6	748	400	348
		8	236		3.2	52.6	655	400	255
1916		22	100		43.1	54.9	117	72	45
		15	100		29.0	54.9	164	72	92
		9	100		13.7	54.9	178	72	106
		22	150		31.4	54.9	182	72	110
		15	150		24.2	54.9	207	72	135
		9	150		14.6	54.9	205	72	133
		22	200		17.7	54.9	296	72	224
		15	200		5.8	54.9	351	72	279
		9	200		7.1	54.9	247	72	175
1918	Vaughan, R. E.								
	Walker, J. C.	16	200		2.5	25-75	682	186	496
Ohio 1918	Selby, A. D.	25	200			Good Results.			

*In this experiment each treatment was made in triplicate so that the yield and percentage figures represent the average of three plats.

The results obtained in New York and Wisconsin recorded in the preceding table seem to show that one pint of formaldehyde with sixteen gallons of water applied at the rate of two hundred gallons per acre, is the most satisfactory treatment. According to Jagger, an essential part of the recommendation is that the seed be covered to a depth of not more than one inch but, as he points out, this in the majority of cases is superfluous as onion seed are generally covered to a depth of three-fourths to one inch.

The practice of soil treatment with formaldehyde at time of planting is increasing. All states mention excellent results with it. In Massachusetts many growers have not been applying enough solution in the past. The amount as at present recommended (200 gals. per acre) is said to be giving better results.

Sulphur still seems to be considerably used in some states. E. W. Olive reported that many farmers in Orange County, New York, have treated the seed rows with powdered lime and sulphur mixtures for years without securing smut control. On the contrary there is often marked injury in the form of root burning in some cases. In Erie County, Pennsylvania, where sulphur is used to some extent, the results are much in favor of formaldehyde.

Smut was first brought to the attention of collaborators in 1918 as follows:

May..... Wisconsin	May 22..... Pennsylvania
May..... Oregon	June 6..... New York
May 5..... Massachusetts	

Downy Mildew caused by Peronospora schleideni Ung.

This disease was reported from New York, Louisiana, Ohio, Missouri, Washington and California. In previous years it has been reported also from Maine, Connecticut, Pennsylvania, West Virginia, Kentucky, Arkansas, Wisconsin, Michigan, Minnesota, and Oregon. Reports of its non-appearance were received from New Hampshire, Massachusetts, Tennessee, Georgia, Mississippi, Texas, Oklahoma, Indiana, Kansas, Montana, and New Mexico.

In all the states but Louisiana its occurrence was local. During 1918 the damage was slight in most cases, although there was considerable damage in Louisiana and a moderate amount in Washington, while in California severe cases of downy mildew were found in some of the fresh vegetable districts. During 1915 an epidemic of downy mildew occurred in Michigan. Mildew and neck rot are among the deciding factors of onion growing in that state. In the same year in Oregon, where it is one of the most serious onion troubles, the loss was probably in the thousands of dollars.

Wet, warm weather is said to be most favorable for rapid growth of the fungus. Fields in low, wet situations are most affected in New York.

Bordeaux is not always successful. Sometimes this may be due to too few applications of the spray, for in 1916 Bordeaux applied upon onions in Louisiana three times a week throughout the rainy season gave satisfactory results.

Neck rot caused by Botrytis sp.

Neck rot, a storage trouble, was reported mostly from the northern portion of the United States during 1918, though some was found in the South. It was reported from Massachusetts, Connecticut, New York, Pennsylvania, Kentucky, Florida, Texas, Ohio, Illinois, Michigan, Wisconsin, Missouri, Oregon, and California. It has been reported prior to 1918 also from West Virginia, Indiana, and California.

The disease was quite common in Massachusetts, Pennsylvania, and Michigan, and somewhat local in Oregon. There was less than the usual amount in Connecticut.

Considerable loss occurred while the crop was in transit, the infection ranging from 2 to 40% while one car from California was a total loss on account of this disease and soft rot. In Connecticut the crop injury amounted to about 4%. In Pennsylvania the loss was about 1% from neck rot. In Michigan the loss was slight, although in previous years it has been considerable (1915, 50%).

This disease in Pennsylvania seems to be worst on onions grown in fields or ground which is low and not well drained.

While the Globe was most susceptible in Connecticut and Wisconsin (especially bad in sets), South Port was most susceptible in Connecticut. In Wisconsin Bronze was most resistant.

Kiln drying as a treatment was successful where it was tried as an experiment in Wisconsin.

Leaf blight caused by Macrosporium sp.

Leaf blight was reported from Massachusetts, Louisiana, Ohio, and Washington. It has been reported in addition to the above named states prior to 1918 from Rhode Island, Connecticut, New York, Ohio, Indiana, Michigan, and Utah. It has been reported as general in Louisiana for about nine years. Last year it was abundant but less than in previous years. It was general throughout the Connecticut Valley in Massachusetts, and local in Washington.

Considerable damage is caused annually in Louisiana by Macrosporium blight, in 1918 the estimated loss to the seed crop being 25%.

According to D. C. Neal, onions in Louisiana sprayed in the spring were comparatively free from disease and a good quality of seed was produced.

Smudge caused by Vermicularia circinans Berk.

Smudge was reported from Massachusetts, New Jersey, New York, Pennsylvania, Delaware, Virginia, Louisiana, Texas, Ohio, Indiana, Illinois, and Wisconsin. Reports stating that it had not been collected in the field in 1918 were received from Maine, New Hampshire, West Virginia, Kentucky, Tennessee, South Carolina, Georgia, Florida, Oklahoma, Arkansas, Missouri, Kansas, Montana, Wyoming, Colorado, Nevada, Washington, and California.

It was mostly local in its occurrence except in Wisconsin, where it was said to be general. There were no reports of serious losses.

The white varieties were reported badly affected in Massachusetts, Delaware, and Wisconsin, while red and yellow varieties were mentioned as resistant in Wisconsin. A 1906 report from New York states that in that year Vermicularia was abundant on a red variety.

Black mold caused by Aspergillis niger

This storage and transit trouble caused a moderate amount of damage in 1918 although at times the infection was reported as high as 90%. It was found on shipments from New York, Pennsylvania, Texas, Ohio, Indiana, Illinois, Missouri and California.

In the central portion of California a heavy rainfall occurred after the onions were dug but remaining in the field, which resulted in a heavy infection. According to growers and shippers in the Coachella Valley, the crop was affected to the extent of 90%. Many bulbs held over for planting were so badly decayed that they were dry and powdery like puff balls.

Pink root caused by Fusarium malli, Taub.

This disease was reported from Louisiana and Texas. It was general on onions in some fields of Lafourche Parish. In Texas it was very general in the Laredo district, but was slight in Mission and McAllen district.

The damage caused by this organism was slight in Louisiana but in Texas large losses were experienced. In the Laredo district the yield was reduced about 50% on 4,000 acres, while in the Mission and McAllen district the loss was unimportant.

Affected plants produce very small bulbs. The disease may and does affect seedlings in the seed bed, or plants may be first attacked in the field after setting. It was apparently worse on land in which onions had been grown for several years.

Varieties show certain differences in susceptibility, the most susceptible being the Crystal Wax. White and yellow varieties are more susceptible than red.

Since the causal factor is found in the soil, rotation is suggested as a means of control. In the Mission and McAllen district of Texas, where rotation is considerably practiced, pink root is not a factor in onion growing. One field in this district which had grown onions for six years showed considerable amount of the disease as did the old onion lands in the Laredo district, where four to five year rotation periods were not long enough to starve out the organism after it had become firmly established.

Steam sterilization or formaldehyde disinfection of seed beds is successful. Lime applications are not successful. Fertilizers rich in nitrogenous and organic matter are especially valuable for use in infested soils.

Fusarium rot caused by Fusarium sp.

Occurred in New England and the Pacific northwest during 1918. It was reported from Massachusetts, Connecticut, Idaho, and Washington. The same, or similar troubles have been reported several times from Ohio and once from Louisiana, but so far have not done any great damage. Judging by the work of Fusaria on other hosts, one is led to look upon this disease with suspicion and watchfulness.

Soft rot caused by Bacillus carotovorus Jones.

Bacterial soft rot was the cause of heavy losses during 1918. A large part of the injury occurred in transit. In inspection at the various markets decay was found in onions originating in the following states: California, Florida, Colorado, Illinois, Iowa, Kentucky, Louisiana, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Pennsylvania, Texas, Virginia, and Washington, also three cars of Spanish onions inspected at New York.

The largest number of shipments originated in Texas, the contents of 73 cars showing decay. Of this number an average of 40-45% bacterial soft rot was found in 33 cars of onions; the onions in the other 40 cars showed 3 to 15% decay with a probable average of about 8%. Many cars from Texas contained onions of Bermuda varieties.

California onions ranged from 5 to 15% in a majority of cars, and 30-45% decayed onions were found in 4 cars, a large part of which was complete decay.

An average of 9% decay was noted in 23 cars of onions presumed to have originated in Illinois, the onions in 3 cars being more heavily decayed. Iowa onions also were badly decayed, much complete decay being noted.

The onions from the other states named were somewhat less decayed.

Imported Spanish onions were badly decayed, 50% of the onions in 2 cars being worthless. Only slight decay was found in the other car of onions, about 25% of contents affected.

Other diseases.

Root knot caused by Heterodera radicicola (Greef.) Mull. was reported from Texas. Great difficulty was experienced in growing onions on a farm at Laredo because of nematodes.

Tip burn was reported from Iowa as very common and destructive.

Mosaic of onion has so far been very local as reports concerning its occurrence have come only from West Virginia, where it was observed on the variety Multiplier in 1917. In 1918 in West Virginia it was doing a moderate amount of damage in Fayette County, and a slight amount in Barbour County.

Blossom blast was reported from Connecticut, where it occurred in less than usual amounts. The crop injury was small.

Rot caused by Sclerotinia sp. was reported from Florida and Ohio. It was local in Ohio where it appeared in 1915 and 1917. Reported from Washington in 1915. This decay was found to be present in 3 cars of onions, 2 from Texas and 1 from California. Decay in Texas onions ranged from 3 to 16%, California onions averaging about 6%, the decayed onions having the white mold characteristic of S. libertiana.